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DEVELOPMENT OF SCIENTIFIC, ENGINEERING, AND OTHER PROFESSIONAL MANPOWER

(With Emphasis on the Role of the Federal Government)

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BY

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FOREWORD

This report was prepared in response to a request received from Senator Henry M. Jackson, chairman of the Subcommittee on Military Applications, of the Joint Committee on Atomic Energy, and subsequent requests received separately, in the chronological order named, from Senators Hubert H. Humphrey, John Marshall Butler, Norris Cotton, and Charles E. Potter. Representative Carl Elliott, chairman of the Subcommittee on Special Education, of the Committee on Education and Labor, also requested a comprehensive report on this subject. During the course of the study, which covered a period of months, a number of other Members of Congress have asked the Legislative Reference Service to furnish them information such as is contained herein.

The purpose is to provide a broad, analytic, informational base for congressional determination of the future role of the Federal Government in the production of scientific, engineering, and other professional manpower—whether that role should be expanded, reduced, or continued without change.

The report brings together, digests, and summarizes recent statistical studies and published opinions bearing on the subject. It reviews the historic role of the Federal, State, and local governments in education, particularly of professional personnel, emphasizing considerations of policy and precedent. It describes the present contributions made by Federal agencies and by national nongovernmental organizations toward professional manpower development.

It reviews action taken by the 84th Congress affecting the problem, and summarizes the relevant proposals which were introduced in that Congress but were not enacted, and have been, or presumably may be, reintroduced in the 85th Congress. It reviews and summarizes nonCongressional proposals to relieve the professional manpower shortage.

On the basis of this broad study, the report gives a critical analysis of the problem. The analysis sets forth important considerations and points out implications for legislation.

The study was carried out and the report prepared by Charles A. Quattlebaum, principal specialist in education on the staff of the Legislative Reference Service. Merwin S. Phelps, Barbara Spencer Marx, and Herman A. Sieber gave research assistance, and Gertrude M. Campbell, secretarial assistance.

Appreciation is expressed to Dr. Lloyd E. Blauch, Assistant Commissioner for Higher Education and Dr. Henry H. Armsby, Chief of Engineering Education, United States Office of Education, to Dr. Howard A. Meyerhoff, Executive Director, Scientific Manpower Commission, and to Dr. G. Kerry Smith, executive secretary of the Association for Higher Education, for their cooperation in critically reviewing the report.

ERNEST S. GRIFFITH,
Director, Legislative Reference Service.

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DEVELOPMENT OF SCIENTIFIC, ENGINEERING, AND OTHER PROFESSIONAL MANPOWER

(With Emphasis on the Role of the Federal Government)

INTRODUCTION

The purpose, nature, and scope of this report, briefly indicated in the foreword, call for elucidation here.

The report essentially does two things: (1) It brings together, digests, and critically summarizes extensive, selected information bearing on the question of the development of scientific, engineering, and other professional manpower; (2) on the basis of this study it critically analyzes the problem as a whole.

The purpose is to provide a broad, informational base for congressional determination of the future role of the Federal Government in the production of scientific, engineering, and other professional manpower. The Federal Government is already playing an important role in this development and, through existing legislation, will continue to do so. However, modification of the Federal role by the 85th Congress could momentously affect the national welfare.

This report assumes that, in order intelligently to consider the many proposals for Federal legislation affecting the development of technical and professional manpower, Members of Congress need organized information concerning a number of matters. Some of these are emphasized herein, namely: (1) The findings from statistical studies bearing on the subject—including United States and Soviet Union comparisons; (2) the opinions of experts and other thinkers on various aspects of it; (3) the historic Federal role in education of professional personnel, especially with respect to policy and precedent for current proposals affecting that role; (4) the historic role of the States in education; (5) current Federal programs giving aid to students for professional training; (6) other Federal programs and activities contributory to the development of professional personnel; (7) activities of nongovernmental organizations promoting the development of such personnel; (8) relevant laws enacted by the 84th Congress and proposals introduced in that Congress which were not enacted and have been or are apt to be reintroduced in the 85th Congress; and (9) noncongressional proposals, by organizations of various kinds and by prominent individuals.

This report does not deal fully with all aspects of the complex manpower development problem. Any one of a number of its aspects might constitute the subject of more extensive study, including congressional hearings. Full pursuit of all of the ramifications of the subject would be an undertaking for a commission. However, it is believed that this study has brought forth a sufficient number of the

important facts and considerations to constitute a basis for the general consideration of relevant legislative proposals.

The information given in this report has been drawn from a wide variety of sources—principally from recent publications of various kinds, but also from correspondence and conferences with officials of Government agencies and nongovernmental organizations, and from other origins.

Throughout the course of the study, congressional interest has been the dominant concern. For example, in selecting material from the overwhelming volume of literature bearing on the subject, determining criteria for the selections have been expressed in such questions as: Would this article probably be of interest to Members of Congress? Is it significant in relation to possible Federal legislation?

Also, in the *organization* of the report, primary consideration has been given to the needs of Members of Congress. The report has been organized for use as a reference work. Members of Congress may be interested in only certain parts of it, but these parts may not be the same for all Members.

On the assumption that some Members will have time for only a minimum of reading, the report begins with a three-way analysis of the problem, including a summary of implications for legislation. Each chapter begins with a summary of its contents, but, for the Member who is interested in fuller information on one or more aspects, additional material is provided.

The critical analysis of the problem (1) describes its general nature, (2) sets forth considerations entering into it, as shown by findings and conclusions from the study, and (3) summarizes the implications for legislative action. While some of the considerations set forth herein are unfavorable toward certain legislative proposals and others are favorable, limitations of time and availability of materials preclude exhaustive pro and con studies of specific proposals.

PART I. CRITICAL ANALYSIS OF THE PROBLEM

The following discussion analyzes the problem of scientific, engineering, and other professional manpower development from three approaches or viewpoints: (1) The general character of the problem, (2) considerations entering into it, and (3) the implications for legislation discerned in findings from this study. These analyses are closely interrelated.

CHAPTER I

GENERAL CHARACTER OF THE PROBLEM

A. SUMMARY

Our development of more and better trained scientific, engineering, and other professional manpower is important to our national survival. It is fundamentally an educational problem, involving the whole organization and system of education in the United States. The problem can be attacked from many approaches. There is no single solution.

B. IMPORTANCE OF THE ISSUE

In an address on the occasion of the centennial celebration of the National Education Association on April 4, 1957, President Eisenhower told the Nation:

> Our schools are strong points in our national defense. Our schools are more important than our Nike batteries, more necessary than our radar warning nets, and more powerful even than the energy of the atom.[1]

Recent shortages of scientists, engineers, teachers, and other technical and professional personnel have drawn nationwide attention to the general problem of trained manpower development in the United States.

President Eisenhower has pointed out that there are a number of fields in which we have trained manpower shortages. In a special message to Congress on January 12, 1956, the President declared:

> Shortages now exist in medicine, teaching, nursing, science, engineering, and in other fields of knowledge which require education beyond the high school.

Publicity given in this country to the phenomenal development of scientific and engineering manpower in the Soviet Union has emphasized our shortages in certain fields.

Many of our national leaders and other thinking citizens have expressed alarm over the shortages, and deep concern over the manpower development problem in general.

The solution of the problem is important to our national survival.

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[1] White House release. Text of the President's address.

Our survival depends upon maintaining the technical superiority of the free world over the Communists, and the maintenance of that superiority largely depends upon our having enough scientific, engineering, and other technical and professional personnel, with enough training of sufficient quality, to outthink and outproduce them.

General Nathan F. Twining, Chief of Staff, United States Air Force, has declared that—

> The security of our Nation in the years ahead depends as much on the wisdom and skill of our engineers, scientists, and technicians, as it does on the courage of our fighting men in our Army, Navy, and Air Force.[2]

Russia's rulers have repeatedly proclaimed their undeviating determination to establish a Communist world under Russian domination. However, some time ago it became apparent that in this atomic age military attack upon the United States would lead to total destruction of the power of the aggressor. In recognition of that prospect, the Soviet leaders launched, and now have well underway, another and prolonged form of warfare. International communism has openly challenged the West to competition in the field in which the United States has long taken most pride in its eminence—technological achievement.

Chairman Lewis L. Strauss, of the United States Atomic Energy Commission, has said that—

> If there is to be another (shooting) war among the great nations of the world before the human race discovers a method of abolishing resource to combat, that war may be survived by the country with the greatest stockpile of nuclear weapons and instruments of their delivery. But such a war will almost certainly be lost by the country with the fewest resources in trained manpower.[3]

Lt. Gen. Emmett O'Donnell has declared that—

> We are losing a war. We are losing it because we are losing the race to produce more and better engineers and scientists than the Communists are doing.[4]

Former Senator William Benton, now publisher of the Encyclopedia Britannica, has said that—

> A recent trip to the U. S. S. R. has convinced me that education has become a main feature of the cold war; that Russia's classrooms and libraries, her laboratories and teaching methods may threaten us more than her hydrogen bombs * * *.
>
> The Communists from the earliest days gave up *butter* for *guns*, but they gave up *meat* for *education*.[5]

As an expression of what the Soviet "peace offensive" means to the Communists, N. S. Khrushchev, First Secretary of the party, recently said:

> We don't have to fight. Let us have peaceful competition and we will show you where the truth lies. * * * Victory is ours.[6]

He also recently said:

> * * * we say to the gentlemen who are waiting to see whether the Soviet Union will change its political program: Wait a blue moon. And you know when that will be.[7]

These statements are indicative of the importance of our manpower development problem in relation to the national defense. Other

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[2] Air Force magazine, September 1956.
[3] Aircraft Industries Association. Planes, January 1955.
[4] O'Donnell, Lt. Gen. Emmett, USAF, writing in Signal, May–June 1956, p. 31.
[5] NEA Journal, May 1956.
[6] School and Society, May 26, 1956, p. 175.
[7] The Current Digest of the Soviet Press, January 11, 1936, p. 3.

aspects of the importance of the problem will be developed later in this report. In pursuit here of the initial purpose of giving a concept of the general nature of the problem, let us consider another of its principal characteristics.

C. ITS BASIC EDUCATIONAL NATURE

The problem is fundamentally an educational one.

The shortages of engineering, scientific, and other professional manpower are not shortages of population in general. The United States has enough potential manpower resources to meet all its needs. This Nation has never had cause to fear annihilation merely because some other countries, such as China and India, have had larger populations. In the present science-dominated world, overshadowed by the aims of international communism, mere increase of the population of the United States offers no hope for our national survival. Recently expressed concern over the national birthrate relates principally to the educational problems resulting, rather than to any fear of a possible shortage of births.

The shortages are not shortages of native ability. Our intelligence as a nation is evident. Our capabilities as a people have been demonstrated beyond question.

What then is the cause for alarm? What is the nature of the shortages about which the public press has been clamoring? Where are the national manpower weaknesses that are troubling many of our thoughtful citizens?

The shortages are shortages of *education*, and the weaknesses are our lack of adequate provisions for it.

Dr. L. A. DuBridge, president of the California Institute of Technology, has pointed out that—

> What we are facing is not a shortage of talent, but of *trained talent*. Intelligent youngsters are not in short supply, and if we made good use of the resources available to us we would be in no difficulty.[8]

The demands for trained manpower are increasing in all fields. Therefore, we should expect to have trained manpower shortages when we consider that the Nation is spending 2¾ as much for alcoholic beverages as for its colleges and universities.[9] We should expect to find serious weaknesses in the school system of our society which pays some professional baseball players many times the annual salaries of teachers.

The war which international communism is waging against us has been referred to in recent literature as the "war of the classrooms." It is a war which at present is not being fought with such spectacular weapons as guided missiles, but which is employing a proper instrument of civilization seized upon and converted to use as a weapon; namely, education. With that instrument we may be eventually defeated unless we awake to its more effective use for our own defense. As illustrated in the quoted statements by Khrushchev, Soviet leaders have said they propose to win through peaceful competition.

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[8] Address of April 14, 1956. Printed at the California Institute of Technology, p. 7.

[9] The total expenditure for alcoholic beverages in the United States for 1955, according to the Office of Business Economics, U. S. Department of Commerce, was $10.09 billion.

The total income of higher educational institutions—publicly and privately controlled, and including subcollegiate departments—from all sources including student fees, private benefactions, and the Federal, State, and local governments, was $3.34 billion for 1953–54, according to the Office of Education, U. S. Department of Health, Education, and Welfare.

Upon the solution of our educational problems largely depends the future of our country. "What happens to American education will eventually happen to America." [10]

D. DEPTH AND BREADTH OF THE ISSUE

A thorough probing into the trained manpower problem reveals that it indeed runs deep and wide. It is not a problem merely of a temporary shortage of scientists and engineers. This shortage represents the most publicized aspect of the problem. It is an aspect of great importance to the national welfare; but it is only a part of the problem—the part presently most obvious, on the surface. However, careful examination reveals that it is inseparable from other shortages of trained manpower—other aspects of the problem.

Let us look more deeply. Underlying the shortages of scientists, engineers, and other technical and professional manpower are all the major problems of education in the United States. Lying among these is the mother of all the rest—the general problem of financing education. It is the cause of inadequate buildings and facilities, insufficient vocational counseling of students, and low salaries for teachers.

The financial problem is not one of total financial resources. This Nation is rich enough to finance all its educational needs. The financial problem grows out of (1) the sense of values in our society which may give a movie actor or a "professional" boxer an annual income that makes the pay of a teacher or scientist look like a mere pittance, and (2) the methods of financing education in this country which are not yielding adequate support of it throughout the Nation.

Even if restricted to the development of adequate scientific and engineering manpower, the problem covers all educational levels. The education of scientists and engineers begins in the kindergarten and extends through graduate work in institutions of higher education.

The problem involves a multiplicity of considerations, such as current and prospective enrollments in schools and colleges, their financial difficulties, the shortage of teachers, school construction needs, and many other factors. It involves the whole philosophy and system, and particularly the financing of American education.

E. CONTROVERSIAL ASPECTS

Reading any one of a number of recent articles dealing with the status of the professional manpower problem of the United States might lead to the conclusion that "This is it; this is the situation and the answer to it." Perusing another article might arouse doubts about the conclusiveness of the first one. Examination of several publications would probably give the impression that some aspects of the matter are quite controversial. Extensive study of the literature bearing on the subject would confirm that impression.

There is some disagreement as between relevant statistics from different sources. There is a much greater disagreement over their interpretation, and over the proper answers to the problem. For example, there seems to be some question as to whether we now have or have not, more scientists and engineers than the Russians. Some

[10] Council for Financial Aid to Education. Aids to Corporate Support of Higher Education. Back cover.

people think it is of the utmost importance that we have more. Others say the difference in numbers is not so important as are the *quality* and other factors that should be taken into account.

While the compilation of statistics is basic to a study of the problem, the correct interpretation of the data and discovery of their implications for the national welfare are essential to finding the right remedies.

F. THE LEGISLATIVE QUESTION

Since the congressional interest in the problem is the primary concern of this study, the question arrived at is: What legislation, if any, should the Congress enact dealing with this problem? The Federal legislative question is obviously not a simple one.

The surface issue might be stated as: What Federal legislation, if any, should be enacted further to promote the training or development of scientific, engineering and other professional manpower? The underlying issue might be stated thus: What legislation, if any, should the Congress enact for the advancement of education in the United States, particularly by means of aid to the financing of education?

The legislative implications of the findings and conclusions from this study as related to these questions will be discussed later in this report.

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CHAPTER II

CONSIDERATIONS ENTERING INTO THE PROBLEM

A. INTRODUCTION AND SUMMARY

The following statement of considerations, while based to some extent upon the subsequent chapters of this report, also sets forth findings and conclusions influenced by material not specifically included in the subsequent chapters. Some of these additional sources are identified in footnotes.

Considerations entering into the problem include such matters as (1) the size of our general educational task, (2) comparisons of professional and subprofessional education in the Soviet Union and in the United States, (3) our shortages of professional personnel and the reasons therefor, (4) Federal policy and precedent in the field of education, and many other factors.

B. SIZE OF THE GENERAL EDUCATIONAL TASK

Technical and professional manpower development is an integral and inseparable part of the general educational task in the United States. The size of that task is staggering to the imagination. Within recent years its growth has been tremendous due to (1) sheer increase in number of persons to be educated, and (2) rapid and far-reaching changes in the variety and scope of subject matter to be taught.

The total population of the United States grew from 162,114,000 in the fall of 1954 to about 168,029,000 in the fall of 1956—about 3 million a year.

In 1936 the Census Bureau predicted the population of the United States might reach 165 million in the year 2,000. The 165 million figure was actually reached in 1955. The number of babies born in this country increased from 2,500,000 in 1936 to about 4,250,000 in 1956. Every day adds several thousand people to the population of our country.

From the fall of 1954 to the fall of 1956 the population aged 5 to 17 years increased nearly 3 million. The enrollment in elementary and secondary schools increased over 2 million in the 2-year period.[1]

The estimated college and university enrollment in 1956–57 is 3,232,000 as compared with last year's 2,996,000.[2] While in 1900 only 8 percent of those in the 14 to 21 age group were in school or college, now 62 percent of that age group are in school or college.

Unlike the governments of some other countries, our form of government calls for education for all of our people. Alexander J. Stoddard has pointed out that "Education is the means through which

[1] U. S. Office of Education. Supplement to Circular No. 490, January 1957.
[2] Ibid., press release dated September 2, 1956.

our country's purposes are realized and through which the country itself is perpetuated." [3]

Our national policy and philosophy of education call for searching out and fully developing the talents of each child. The weaknesses of each one are to be studied and, so far as possible, corrected. The national ideal demands opportunity for every American to attain the highest level of education and training of which he is capable.[4]

The demands are constantly increasing for more and better education. The number of vocations requiring specialized training has multiplied. A citizen must have a fairly broad general education fully to understand his daily newspaper and intelligently to participate in ordinary affairs of government. In every field of subject matter the content and significance for modern living have multiplied. "Yet relatively we seem to be falling behind in the race between ignorance and wisdom." [5]

This contemplation of the size of our educational problem as a whole leads to the consideration of some of its elements which are of particular concern in this study of scientific, engineering, and other professional manpower development.

C. COMPARISON OF UNITED STATES—U. S. S. R. SCIENTIFIC TRAINING

Although there seems to be some question as to whether the United States or the Soviet Union now has more scientists and engineers, there is no doubt that educational institutions in the Soviet Union are now annually awarding more degrees in science and engineering than are colleges and universities in the United States. Many persons regard this fact alone as indicative of a great danger to this country. Perhaps so, but there are important observations affecting the significance of numbers.

There is some opinion that the Soviets already have an overproduction of scientists and engineers, and that many of their people trained in science and engineering are being utilized in other fields. Although in some respects the training given Soviet engineers and scientists compares favorably with the best in America, there are weaknesses in the Soviet educational system. These include political-doctrinal domination of education, general rigidity of subject matter, and stereotyped teaching. On the other hand, in the United States there are weaknesses resulting from shortage of competent science teachers in secondary schools, loss of enrollment between high school and college, and dropout of able students after college entrance.

For 2 years an assessment of Soviet scientific education has been in progress at Massachusetts Institute of Technology. The director of the project has concluded that scientific training in the U. S. S. R. is generally excellent in the universities, but much below western standards in engineering schools.[6]

In making comparisons between scientific personnel and training in the United States and the Soviet Union, it is important to bear in mind also the great political, economic, and social differences. The

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[3] Stoddard, Alexander J., Schools for Tomorrow: An Educator's Blueprint. Fund for the Advancement of Education, 1957, p. 15.

[4] Ideals expressed in statements from the President's Committee for the White House Conference on Education and from the American Council on Education.

[5] Stoddard, Alexander J., op. cit., p. 17.

[6] How Good Is Soviet Science? Fortune, February 1957, p. 120.

resultant differences in training and utilization of personnel in the two countries makes comparison of numbers less meaningful.

In education, not only are the organizational and administrative structures different, but the aims and methods are different. Throughout the Soviet system great stress is placed on specialized technical education. In the United States recognition is given to the necessity of combining technical training with other forms of education for the maintenance of a democratic society.

This is not to minimize the quality and effectiveness of Soviet technical education. It is only to draw attention to some of the inconsistencies in a numbers race with the Soviets.

Some impressive testimony concerning the high quality of Soviet training in the sciences has recently appeared in print.

On February 14, 1957, Dr. Edward Teller, world-renowned American physicist who was intimately associated with the development of the hydrogen bomb, stated that the United States cannot keep its lead in science. In an address before the Air Force Association Jet Age Conference in Washington, he said that "10 years from now the best scientists in the world will be found in Russia." He pointed to the Soviets' devotion to technological training and their elevation of the position of scientists, and advocated raising the standards of the scientists in the United States and increasing the pay of high-school science teachers.[1]

D. OUR SHORTAGE OF SCIENTISTS AND ENGINEERS

Consideration of our needs without reference to Russia is also advisable. Several studies have shown that there is a growing demand for scientists and engineers in the United States. A 1956 study by the B. H. Goodrich Co. led to the conclusion that unless we take steps to increase our present rate of graduation there will be a shortage of perhaps 100,000 scientists and engineers in this country 10 years hence. However, some persons have predicted that the present shortages will gradually diminish from effects of the increased postwar birth rate, larger enrollments of students for college training in shortage fields, and other factors.

Within the last several years there have been large increases in college and university enrollments for courses in science and engineering. Greater numbers of high-school seniors ranking high scholastically are choosing careers in fields in which there are national shortages of personnel.

The National Science Foundation has estimated that at the present rates of graduation there will be between 71,000 and 87,000 science and engineering graduates a year by 1960 and between 103,000 and 113,000 by 1965.

However, available data do not offer great hope for quick reduction of our trained manpower shortages.

Speaking before the Air Force Association Jet Age Conference in Washington on February 14, 1957, Dr. Detlev W. Bronk, president of the National Academy of Sciences, said that our national need for more and better trained manpower is "desperate."

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[1] Yarborough, Charles J. United States Can't Keep Its Lead in Science, Teller Says. Washington Star, February 14, 1957, p. 1.

Addressing the same meeting, Lt. Gen. C. S. Irvine, Deputy Chief of Staff for Air Force Materiel, said that failure to meet demands for highly trained specialists and technicians will—

> cancel out our present achievements and nullify our prospects for projecting security and prosperity into the future.[8]

E. REASONS FOR SHORTAGE OF SCIENTISTS AND ENGINEERS

Various reasons for our shortage of scientists and engineers have been given in recent writings. It is apparent that a basic reason is the increase in demand caused by revolutionary scientific discoveries, and technological advances in general. The ratio of scientists and engineers to the total working population has increased greatly in recent decades, but not sufficiently to meet the demands of our science-dominated economy.

Growth of the demand is seen in data compiled by the National Science Foundation, which has estimated that, in relation to the number in 1955, by 1970 the need for highly trained scientific and technical personnel will (1) nearly double for high-school teaching, (2) increase from 169,000 to 495,000 for college and university teaching, grow from 700,000 to 1,550,000 for engineering jobs, and markedly increase for research and development—for which expenditures are expected to grow from $5.5 billion to $8.1 billion.

Advances in the use of atomic energy and other developments have caused a demand not only for greater numbers of scientists and engineers but also for much more advanced training—which many students have had insufficient motivation to undertake.

After World War II, there was a widespread expectation that the need for scientists and engineers would be reduced. As a result, many students were counseled against undertaking scientific and engineering courses.

The low birthrate of the prewar years also contributed to the present personnel shortages, along with financial difficulties of some students, dropout of able students for lack of motivation, the period out for military service, and other causes which will be brought out later in this discussion. Generally these are offspring or close relatives of the ever-present, overall problem of financing education.

F. SALARIES AND PRESTIGE OF SCIENTISTS

An important consideration in the scientific manpower problem is the income and position of the scientist in our society. While young graduate engineers are now being offered salaries which appear very high in comparison with those offered a few years ago, the income of research scientists generally has remained low. Many of these are employed by or in connection with educational institutions and their salaries are affected by the financial problems of higher education in general.

A recent salary summary published by Engineers Joint Council revealed that teachers of engineering in the higher academic ranks, especially in large institutions with excellent reputations, are, partly through consulting work, earning as much as engineers in industry. In certain other branches of science, notably physics, chemistry, and geology, this is likewise the case. On the other hand the instructors in

[8] Yarborough, Charles J. Op. cit.

large institutions and professors in small institutions of little reputation have relatively small incomes.

In November 1956, the National Science Foundation reported salary information obtained from about 47,000 employed scientists listed in the National Register of Scientific and Technical Personnel. The annual professional salary of only half of these was more than $6,525. Half of the physicists were receiving less than $7,275 annually.

Much is being said concerning the position of the scientist in American society as compared with his position in the Soviet society.

In the United States scientists are widely regarded as being somewhat "peculiar"; and questioning of high-school students has shown that many of them hesitate to enter scientific careers because of the public attitude toward scientists generally, and because of the low pay of scientists.

On the other hand, scientists (including science teachers) in the Soviet Union generally enjoy fabulous living standards in relation to those of the general population. The position of a scientist is one of great prestige. Scientists enjoy safety and freedom not allowed the general population.

An article in Fortune magazine for February 1957, stated that—

> Some western scientists who have visited the Soviet Union have returned talking like poor boys after a vacation on the country estate of rich relatives.[9]

One western scientist expressed amazement at the "worship" of scientists everywhere in the Soviet Union.

G. THE TEACHER SHORTAGE

Basic to the continuing shortage of scientific, engineering, and other professional manpower is training in science, engineering, and other fields, and basic to the shortage of training is the shortage of teachers.

According to estimates of the National Education Association there is a shortage of about 180,000 qualified elementary and high-school teachers in the United States in the current school year, 1956–57. Data compiled by the association also show teacher shortages in all subject fields in degree granting institutions, particularly in mathematics, the physical sciences, and education.

Widespread publicity has recently been given to this shortage of teachers, at all educational levels—kindergarten through university. However, the American people have been hearing so long about the shortages in the teaching profession that the public sense of the importance of this shortage has become dulled by its endurance. The public awareness of the need for more and better qualified teachers is like the dulled ache of an old wound. The public clamor over the shortage of scientific and engineering personnel is an outcry impelled by the realization of a new danger.

However, in an address to the American Council on Education on October 11, 1956, the Secretary of Health, Education, and Welfare, Marion B. Folsom, pointed out that—

> * * * It is true that we are seriously short of trained scientists and engineers. It is also true, however, that we face shortages in several other categories of trained professional personnel, including physicians, dentists, nurses, business

[9] How Good Is Soviet Science? Fortune, February 1957, p. 194.

and Government executives, and supervisory personnel. Most critical of all, perhaps, is the shortage of school and college teachers. A careful study indicates that by 1966, the Nation will need more than 600,000 additional teachers. In our zeal to provide scientists and engineers, we must not overlook the needs of other professions.

The Director of the National Science Foundation, Dr. Alan T. Waterman, has admonished that in order to train enough scientists and engineers we must first strengthen our whole educational system and provide much stronger incentives for good teachers.

In an address before the convention of the Air Force Association in August 1956, Gen. James McCormack, Jr., assistant to the president of Massachusetts Institute of Technology, aptly phrased a similar conclusion in the statement that—

> * * * the shortage of good teachers has the unique potency of multiplying all other shortages in the development of succeeding generations.

Associated with the teacher shortage is the shortage of trained librarians. The American Library Association reports that the number of professional library vacancies is estimated at 10,000 with a bleak prospect of only 1,000 graduates in Library Science in 1957.[10]

H. SALARIES OF TEACHERS

The National Education Association has drawn attention to low salaries as the principal contributing cause of the teacher shortage in general.

Among other findings the association reported in 1956 that the average salary is now $4,025 for elementary school teachers and $4,560 for high-school teachers. However, close to 71,000 classroom teachers are being paid less than $2,500. The salaries vary markedly among the States, 7 of which reported that more than 25 percent of their classroom teachers were receiving less than $2,500 a year. On the other hand, 20 States reported that more than 25 percent of their classroom teachers were receiving $4,500 or over per year.

Another 1956 report of the NEA gave a median salary of $5,243 for teachers of all ranks combined in universities, colleges, and junior colleges. The median salary for full professors was given as $7,076, and for associate professors $5,731. These salaries were for the 9-month academic year, with opportunities for summer teaching for additional compensation in some instances.

The salaries of teachers in institutions of higher education in the United States are in sharp contrast with those in the Soviet Union. There the average professor earns perhaps 10 times what an ordinary Russian worker gets. Outstanding professors and research scientists receive the Russian equivalent of the salary of an American corporation president.[11]

The position of professor is very highly regarded in Russia and the best talent is ready to enter the competition for professorship.[12]

The NEA report concluded that—

> The shortage of competent teachers can rightly be attributed to a number of contributing causes, but one stands far above others in importance: insufficient

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[10] Information obtained from the Education Division, American Library Association.

[11] Benton, William. Now the "Cold War" of the Classrooms. New York Times magazine, April 1, 1956, p. 44.

[12] Timoshenko, Stephen P. The Development of Engineering Education in Russia. The Russian Review, July 1956.

salaries. Employing officials—elementary school, secondary school, and college—lack the necessary funds to enter the free competitive market and obtain the services of superior teachers in the numbers needed by today's educational system.

The report stated that emergency provisions for teaching at all levels are in operation "almost everywhere" in the United States.

A January 1957 publication of the Fund for the Advancement of Education (established by the Ford Foundation) pointed out that—

> Already there is developing some tendency to meet the growing teacher shortage by adopting plans and procedures that constitute turning the educational clock backward. Temporary and substandard certificates are being issued in increasing numbers to those lacking requisite professional training. Requirements of academic education at or below the college level are being lowered. In some localities the proposal has been made that certificates for rural school teaching be granted to high-school graduates.
>
> Thus the progress of the last 50 years in raising academic and professional standards for teaching may be seriously modified or lost altogether. Downgrading our teachers will not meet the competition for manpower of industry and other professions unless it is done so drastically as to affect seriously the integrity of teaching itself.[13]

In the fall of 1956 the number of persons teaching in elementary and secondary schools under substandard certificates (licenses) was 89,400, representing 7.5 percent of the total teaching staff as compared with 6.8 percent a year earlier.[14]

In the fall of 1951 the estimated number of these "emergency" teachers was 69,848, representing 7.3 percent of the total teaching staff.[15]

Many of those teaching on standard licenses will leave the profession after a year or two.

The literature concerning our trained manpower shortages is replete with concern over law salaries and attendant low prestige of teachers as basic causes of our educational deficiencies and technical and professional manpower shortages.

Dr. Maynard M. Boring, then Chairman of the Engineering Manpower Commission of Engineers Joint Council,[16] recently said that the teacher shortage is one of the most critical problems that we face as a nation; and that we must solve the problems of inadequate salaries and low social position of the teacher.

Monroe E. Spaght, executive vice president of Shell Oil Co., said in 1956 that the blame for our critical shortage of scientists and engineers rests squarely on the public for its neglect of its teachers. He said that as we have let our teachers down financially so we have let the prestige and the appeal of teaching fall in this country.

Basic to the shortage of trained manpower in all fields is the training of manpower; basic to that is the teacher shortage; and basic to the teacher shortage is the low pay of the teacher at all educational levels. Basic to the low pay of the teacher is the inadequacy of our provisions for financing education in general.

I. SCHOOL CONSTRUCTION AND THE SHORTAGES

From the study of the relevant literature it appears that the relationship of school housing and equipment to the long-range development of technical and professional manpower is close. The present

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[13] Stoddard, Alexander, J. Op. cit., pp. 17–18.
[14] U. S. Office of Education. Press release, February 18, 1957.
[15] National Education Association. Advanced Estimates of Public Elementary and Secondary Education for the School Year 1952–53 (with revised estimates for 1951–52).
[16] He has since retired from that office.

and prospective shortages of scientific personnel are to a considerable extent attributable to the inadequacy of provisions for housing and equipment for the teaching of science in many of the Nation's secondary schools.

The issue of Federal aid for school construction is too broad for full consideration in this report. A comprehensive study of that question, prepared by the present writer, was printed in February 1955 for the use of the Senate Committee on Labor and Public Welfare,[17] and some more recent reports on the subject have been prepared in the Legislative Reference Service. However, in recognition of the school construction issue as being an important consideration in the present study, some of the findings recently reported by the United States Office of Education pertaining to the need for school construction and facilities will be summarized here, as follows:

While better school housing and equipment have always been sought by many persons, a large, nationwide shortage of school facilities developed during the depression of the 1930's. The shortage grew during World War II, when labor and materials were scarce. Since then there have been by far the greatest enrollment increases in history. Within the past 5 years the enrollment has increased at an average rate of over a million a year. It is expected to increase at an even faster rate for the next 5 years.

In spite of notable increases in construction during the last 10 years, the school housing and equipment needs of the Nation's fast-growing school population have not been adequately met. Most studies show a continuing, substantial, and widespread shortage.

The latest estimates by State education agencies placed the total classroom shortage at approximately 159,000 at the start of the school year 1956–57. This did not take into account future replacement needs or the further large enrollment increases yet to come. In the meantime the shortage means overcrowded classrooms, half-day sessions for many children, and emergency use of makeshift quarters.

The current rate of construction is barely keeping pace with the new needs developing each year, with little reduction of the shortage accumulated over more than two decades. At this rate a serious shortage of school facilities would continue to handicap education in many communities for many years to come.

The basic purpose of some school-construction proposals pending in Congress is to encourage greater State and local efforts to provide more and better school housing, and to supplement these efforts to help overcome the existing deficit. The States and communities are now building schools at a rate which indicates that, once the deficit has been removed, they can finance from their own resources the construction needed for future new enrollment increases and normal replacements.[18]

The issue of Federal aid for school construction is, however, not simple and clear-cut. Many arguments have been advanced for and against the proposal and it has been involved with questions which the chairman of the House Committee on Education and Labor has referred to as proposals for sociological reform.

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[17] Federal Aid for School Construction. Committee print, p. 131.
[18] U. S. Department of Health, Education, and Welfare, Fact Sheet, Education No. 1, January 1957.

J. SUBPROFESSIONAL TRAINING

A major consideration in the problem of trained manpower production is subprofessional training, mainly comprised within the term—"vocational education below college grade." There is some evidence that our shortage of professional scientists and engineers may not be as great as our shortage of subprofessional technicians, though there is a lack of general agreement concerning the meaning of these terms.

Some thinkers on the subject have expressed alarm over the great number of institutions and programs that have been developed in Soviet Russia to train technicians and skilled workers. According to recent information from several reliable sources, Russia now has more than 3,000 "tekhnikums" enrolling more than 2½ million people and graduating annually approximately 70,000 technicians and skilled workers.

Former Senator William Benton, now publisher of the Encyclopaedia Britannica, has pointed out that these institutions are turning out supertechnicians and specialists who fill vitally important secondary jobs, thus leaving graduate engineers free for more highly skilled work. These technicians, who are being trained in propaganda methods as well as in technical fields, are being sent by the hundreds to underdeveloped countries seeking, or at least willing to accept, guidance and leadership in technological fields. The Russian specialists are not only helping these countries with technical problems, but are also spreading the Communist doctrine in many parts of the world. This is an important phase of the "war of the classrooms" against the West.

In an exclusive interview published in the August 1956 issue of the Nation's Business, Assistant Secretary of Commerce Harold C. McClellan pointed to these Russians activities as part of the plan to wreck United States economy and dominate the world. He said in part:

> This is clearly a new international game of matching economic wits. * * * Immediately at stake are awakening millions of people in the underdeveloped areas and the vast potential markets which they represent. Russia wants these people, their trade, and their sympathy. * * * Yes, this is a brandnew phase of the East-West struggle and one as threatening to free world security as the stockpiling of weapons.

At present the United States has very few institutions comparable to the unique Soviet technological schools that are turning out supertechnicians without a college degree. However, throughout America there are vocational schools competent to develop for the youth and adults of the Nation better programs of vocational training of less than college grade if they are able to obtain sufficient funds.

K. FINANCIAL AID TO STUDENTS

Another major consideration in this study is the question of establishing a new program of Federal financial aid to students for higher education. A comprehensive study of this issue, prepared by the present writer, was printed for the use of the House Committee on Education and Labor in June 1956.[19] A few of the elements of the

[19] Federal Aid to Students for Higher Education. Committee print, 191 pp.

issue and its status before Congress at the time of this writing will be briefly pointed out here.

For over 150 years the Federal Government has entirely and directly financed the higher education of selected individudals to prepare them for certain types of national service—principally for service as officers in the Armed Forces. Since 1862, through the land-grant colleges and universities, the Federal Government has indirectly aided other individuals to obtain higher education in certain fields. In recent years the Government has provided scholarships and fellowships or similar direct aid to some persons, mainly veterans, for their higher education in fields of their choice.

After World War II various national organizations and prominent persons began urging the establishment of a general Federal scholarship program to take over at the time of the decline of the program for veterans. In 1949 and 1950 President Truman urged Congress to establish such a program. For that purpose he included an item in the national budget for the fiscal year 1951.[20]

For nearly a decade proposals for different forms of Federal aid to students have been introduced in each Congress. Dozens of such proposals were introduced in the 84th Congress. Some of them have been reintroduced in the 85th Congress, along with new proposals.

The American Council on Education is sponsoring an income-tax credit plan which would provide aid to the higher education of some individuals. The council is also restudying its earlier policy recommendations for a Federal scholarship program. Recent recommendations or proposals for forms of Federal aid to students have emerged from deliberations within (1) the Association for Higher Education, (2) several of the State conferences which preceded the White House Conference on Education, and (3) the representative assembly of the National Education Association.

The arguments pro and con concerning establishment of a Federal scholarship program are reviewed in the aforementioned report.

In recent deliberations over the scholarship issue considerable attention has been given to whether education in the sciences should be emphasized or further promoted by the Federal Government. At the last annual convention of the American Council on Education in Chicago, in October 1956, educators pointed out the need for well-trained persons in the fine arts, the social sciences, religion, history, economics, philosophy, and languages as well as in the natural sciences.

Among others, Dr. Earl J. McGrath, former United States Commissioner of Education and now a director of the Institute of Higher Education at Columbia University Teachers College, discussed this point. He said that if we attempt to siphon off the best brains into the sciences, leaving the second-best to the liberal arts and humanities, our country will suffer in the long run.[21]

Actually, current aims of American education in the sciences and liberal arts tend to minimize conflict between the two. Training in the profession tends to become more liberal, and more science education is being included in a liberal arts curriculum.

Another consideration in the Federal scholarships issue is the question of whether such scholarships, if established, would reach the

[20] Economic Report to Congress, January 7, 1949; Budget message of January 10, 1949, and January 9, 1950.
[21] New York Times, October 12, 1956.

students actually needing them. This involves the question of the value of a means test.

The answer to both of these questions would of course depend upon the nature of the Federal scholarship program and provisions for its administration, and the nature of the means test.

The means test questionnaire, and procedures for handling the questionnaire, which were worked out by the Educational Testing Service for member institutions of the College Entrance Examination Board, have been in use for several years. The member institutions have gone on record several times as to satisfaction with the program and have urged its continuance. The membership includes practically all institutions of higher education in New England and in New York State, and a substantial number of the institutions in other States.

The Federal scholarship program which has been proposed by the Committee on Relationships to the Federal Government, of the American Council on Education, includes a means test. According to information obtained from the council, the committee which formulated the plan concluded that a means test is desirable and that satisfactory procedures for administering such a test are in existence.

Proposals for a program of Federal financial aid to students also raise the question of whether such a program should provide scholarships or loans, or both. The answer is, of course, a matter of opinion. Bills proposing each of these types of program are pending in Congress. It might be pointed out here that loan funds available to students in many institutions of higher education are not being fully used. This is well known in educational circles. Apparently many young men and women are unwilling to place themselves in debt at the start of their careers. Whether Congress can devise a loan plan to persuade financially needy young people of superior ability to attend college in their own and the national interest is open to question.

In March 1957, the Honorable Carl Elliott, chairman of the Subcommittee on Special Education, of the Committee on Education and Labor, expressed the intention of the subcommittee to hold hearings on the question of establishment of a national scholarship program and related special problems of education. It was expected that the hearings would highlight many facets of the question of trained manpower development.

L. CONTRIBUTIONS OF NONGOVERNMENTAL ORGANIZATIONS TO MANPOWER DEVELOPMENT

Another important consideration in this study is what nongovernmental organizations, particularly corporations, are doing toward reduction of our trained manpower shortages.

Nongovernmental organizations of different kinds—corporations, technical societies, educational associations, and others—are variously contributing to the development of technical and professional manpower in the United States.

The contribution may be specific and direct—such as a scholarship for study in chemistry at a particular institution, or it may be general and indirect, such as an unrestricted grant to an association of educational institutions. The contribution may be as impressive as a corporation's announcement that its total grants-in-aid of higher educa-

tion this year exceed a million dollars; or it may be as modest as a local social club's effort to make the new high school science teacher feel respected in the community. Yet both types of contributions, and many others, have a place in our American scheme of things, and all are important.

Led by the Ford Foundation, a number of corporate concerns have made contributions to the National Merit Scholarship Corp., which began operating in 1955 with over $21 million, the largest single sum ever devoted to scholarships. While this sum is impressive, in 1956 the Educator's Dispatch pointed out that in order to maintain 4,000 men and women in college as hoped for eventually, the sum would have to be built up by many more large contributions.

Although it is a very "heartening event in American education," the establishment of this much-publicized fund can hardly be regarded as a full answer to the Nation's problem of technical and professional manpower development.

In 1956 corporation grants in support of higher education (broadly interpreted) totaled an estimated $100 million. Total voluntary private gifts to higher education from all sources exceeded $500 million. The president of the Council on Financial Aid to Education has estimated that the institutions will need another $500 million a year for the next 10 years.[22]

Many corporations are considering policy questions such as whether they should give to "have" or "have not" institutions, and to tax-supported as well as privately supported ones. Generally, corporate support of higher education is in the early stages of an evolutionary process. No broad policy has been agreed upon by a large number of corporations. Some persons feel that it is as desirable to maintain the existing diversity and competition in corporate support of education as to maintain diversity and competition in higher education itself.

Although there appears to be a trend toward consideration of the national interest, for the most part corporate aid to education is now governed by a number of restrictive criteria. Prominent among such criteria are: (1) the location of company plants, employments or markets in relation to the educational institutions considered for aid, (2) the institutional sources of the corporation's own personnel, and (3) the particular subject field of the corporation's interest. For instance, a corporation may restrict its grants to colleges in certain States in which it owns plants, or it may direct its aid to the institutions which have furnished the largest numbers of its salaried personnel, or provide scholarships for study only in a particular subject field.

In this respect corporation support of higher education differs from any form of Federal financial support of education which is apt to be enacted by the Congress. It is reasonable to assume (1) that any general Federal measure would give primary consideration to the national interest, since the Federal Government represents that interest, and (2) that a Federal grants-in-aid bill would contain a formula for distribution of Federal funds on a State quota or some other equable basis. In contrast, corporation aid is largely restricted to institutions in certain areas.

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[22] Buder, Leonard. College Reliance on Industry Rises. New York Times, January 13, 1957, p. 1.

What the policies of corporate giving to education should be is a debatable question with which this study is not particularly concerned. Probably most people would say that the corporations have a right to decide for themselves how they should spend their own money. This study is concerned with what the policies actually are and their current and prospective effects upon technical and professional manpower production as a national problem.

Consideration of the national interest and responsibility is presumably dominant in the Federal programs, whereas other interests are at present evident in the corporation programs.

This does not imply that corporate giving to higher education is undesirable from the viewpoint of the national welfare. It does imply that such corporate giving is not an attack upon the problem of technical and professional manpower production primarily from the viewpoint of the national interest.

Many nongovernmental organizations other than corporations, such as professional societies, are also contributing to professional manpower development, particularly in the sciences and engineering. Their varied programs include such activities as administering fellowship funds, giving aid to vocational guidance in high schools, and providing "curriculum" enrichment materials. While these contributions are important, they are small with respect to funds made available, in comparison with the corporation grants.

M. PROSPECT FOR REMOVAL OF THE SHORTAGES BY EXISTING FORCES

Another consideration is the question of whether existing forces will remove the shortages of professionally developed "mindpower"—and if so, how soon or how late.

Insofar as this study is concerned, the answer to this question is that a conclusive answer has not been found. However, some persons have ventured predictions. These appear generally to sum up to expression of a doubt that existing forces will make up the shortages in less than a decade under anticipated economic conditions.

Following are some relevant data pertaining only to the shortage of engineers and physical scientists. (Similar data are compiled for other fields elsewhere in this report. The reader is reminded that the scientist-engineer shortage is only one, although the most publicized, aspect of the overall manpower problem.)

The current combined deficits of physical scientists and engineers are most frequently estimated to be from 45,000 to 65,000 persons.

The average annual demand for physical scientists and engineers during the next 10 years is most frequently estimated from 80,000 to 100,000 persons.[23]

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[23] These estimates reflect attempts to combine figures from various sources. The number of newly available engineer and scientist jobs, upon which the "demand" estimates are based, is projected in terms of the estimated gross national product. Adjustment is made to consider the number of deaths and retirements, as estimated by the Bureau of Labor Statistics.

The average annual number of persons estimated to receive first professional degrees in engineering and the physical sciences during the next 10 years is 63,000 persons.[24]

It should be noted, of course, that such forecasts are qualified by a series of variable factors. For example, the prospective number of graduates in physical science and engineering can be forecast reliably only to the extent that (1) college freshman enrollments materialize as estimated by the Office of Education, (2) that a certain percentage of these freshmen choose to specialize in these fields, and (3) that a certain percentage of these students complete the courses prescribed for graduates.

Other uncertain factors affect such projections. Individual value judgments will vary the degree to which allowances are made for these factors.

In case of war or all-out mobilization, there would, of course, be greatly increased demands for highly trained manpower in many fields. Such demands may also be expected to increase in times of peace because of continuing application of technology to industry, calling for more and more advanced training of personnel.

Atomic Energy Commissioner Willard F. Libby last year estimated that the nuclear sciences alone will be able to absorb "at least 20,000 and possibly 50,000 technically trained graduates." [25]

The wide range from low to high estimates of our current and projected shortages appears to be in direct proportion to the degree of emphasis placed upon such predictions as Commissioner Libby's.

The so-called educational crisis is being challenged in some States by significant educational programs. However, questions have been raised as to whether these programs, especially in States of low economic ability, can be stepped up sufficiently without unbalancing the total services of State governments. Total current annual State and local government funds going to publicly controlled institutions of higher education, representing 81 percent of total Government contributions to such institutions, is over $1 billion.[26]

Although limited in several ways, as pointed out earlier in this discussion, corporate support of higher education has increased phenomenally in the last 20 years.

It has been pointed out that approximately $100 million was contributed to colleges and universities during 1956. About half of the largest manufacturing corporations in the United States are providing scholarship aid to individuals. General Motors is planning to spend $5 million annually for scholarships; the national merit scholarships for last year totaled approximately $3 million.

In 1955, General Electric described the "increasingly serious problem" in a full-page newspaper advertisement. Said General Electric:

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[24] For the purposes of this summary, the above estimates are for engineers and physical scientists only. Estimates of current shortages, projected demand and supply, for persons in the biological sciences and the healing arts, would increase these estimates proportionately.

According to Office of Education projections, reported more fully in ch. VI, prospective number of graduates in the physical sciences and engineering total 51,000 for 1957–58, 59,100 for 1959–60, and 77,800 for 1965–66. It should be noted, therefore, that average annual figures will not reflect the projected supply-demand situation of any given year. However, the average annual figures indicate a fairly significant supply-demand relationship, and a continuing shortage.

[25] Haseltine, Nate. Libby Terms Shortage of Scientists Awful, Washington Post, February 18, 1956, p. 8.

[26] Computed from data compiled in the U. S. Office of Education for inclusion in a forthcoming publication of that Office. These data include income of all publicly controlled institutions of higher education from all levels of Government.

> For every 5 new engineers industry needed this year, only 3 were graduated from United States colleges. * * *
>
> We have opportunities for a thousand more technically trained people each year. The need may double in the next 10 years.[27]

The apportionment of some of the costs of higher education to the industrial and commercial organizations is a logical development, considering industry's frantic pursuit of talent.[28] While no one can say positively that the trend of increased corporate support of higher education will continue, it does appear likely in the absence of a business recession.

On the other hand there is evidence that many talented young people have been "priced right out of the college classroom." It has been estimated that each year approximately 100,000 of our Nation's most talented high-school graduates are deterred chiefly for financial reasons.[29] Individual motivation and financial ability to obtain higher education, however, appears to be increasing at present. A helpful measuring rod of this ability is per capita disposable personal income which has increased, in terms of constant 1957 dollars, from approximately $950 in 1930 to over $1,600 this year.

Other considerations bearing upon the prospect for removal of the shortages by existing forces have been brought out elsewhere in this report. These examples will illustrate the conflicting nature of relevant facts and opinions.

Favorable trends, which have been noted, reflect an encouraging vitality of interest in the manpower problem. However, the literature shows there is a respectable body of opinion that existing forces cannot or will not do the job.

Whether Federal action is necessary to effect a concerted offensive to relieve the shortages remains a matter for the decision of Congress. The national interest demands that the shortage of talent will not become, as one General Electric official put it—"a way of life".[30]

N. OTHER CONSIDERATIONS

Some other major considerations in this study are reviewed and summarized in subsequent chapters. These relate to (1) policies and precedents discernible in the history of Federal and State support of education, particularly in relation to technical and professional manpower development, (2) current Federal programs giving aid to students for professional training, (3) other Federal contributions toward the development of technical and professional manpower, including the work of recently appointed presidential committees, and (4) congressional and noncongressional proposals for further Federal action in this field.

The reader is here reminded that this report does not pretend to explore all the ramifications of the complicated manpower development problem, although it supplies a substantial base for congressional consideration of relevant legislative proposals. The report does not blueprint a legislative attack upon the problem, but, in the following discussion of legislative implications, draws some guidelines for approaches to it.

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[27] As General Electric Sees It, Wall Street Journal, Sept. 15, 1955, p. 13.
[28] Needed—More Men With the Answers, Newsweek, Apr. 2, 1956, pp. 67-68.
[29] The President's Committee on Education Beyond the High School, first interim report to the President, Washington, November 1956, p. 5.
[30] Needed—More Men With the Answers, Newsweek, Apr. 2, 1956, pp. 67-68.

CHAPTER III

IMPLICATIONS FOR LEGISLATION

A. SUMMARY

Findings from this study imply, among other things, that (1) there may be a need for Federal and/or State legislation further to promote the training of subprofessional and professional manpower; (2) if there is such a need it has emergency as well as long-range aspects; (3) almost any measure which would promote education in the United States would aid in our "war of the classrooms" with the Soviet Union; but (4) major legislative proposals for such promotion face hurdles of controversy. The findings from this study also contain a number of implications for specific proposals.

B. DEGREE OF FEDERAL RESPONSIBILITY

In considering the implications for national legislation discoverable in this report, the first concern is whether or not the problem involves a Federal responsibility. Meeting the Nation's needs for scientific, engineering, and other professional manpower requires the use of our entire organization and system of education. If the overwhelming total educational task is not a concern of the Federal Government, but only of the States, localities and privately supported institutions, then this study contains no implications for constructive national legislation, and the entire report may be disregarded from this viewpoint. Therefore, let us first consider whether such is the case.

So far as the literature examined in this study is concerned, it contains numerous proposals for Federal action, with little questioning of Federal responsibility in this field. Apparently the writers generally take for granted some degree of Federal responsibility for education, particularly in view of the constitutional Federal responsibility for the national defense, and its increasing demands for highly trained manpower in many fields. At the same time the writers generally acknowledge that traditionally and under the Constitution the principal responsibility for education rests in the States and localities.

Research by this writer and others has shown that in its infancy the Federal Government assumed a share of the responsibility for education. The Federal Government early undertook two types of activities: (1) Operating educational programs of its own, and (2) aiding the States and Territories in financing and promoting education. Federal educational programs and aids have been expanded by numerous actions by the Congress and by the executive branch of the Government, with the support of Supreme Court decisions in some instances.[31]

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[31] Ch. V. of this report is a history of Federal action and policy affecting professional manpower development.

Throughout the history of the country, the Federal Government has, in actual practice, if not in inherent duty, borne a share of the responsibility for education—particularly for the financing of education, and for training in the armed services.

It is therefore apparent that, on the basis of this fact alone, this report contains implications for Federal legislation. The main question is whether the findings and conclusions from this study point toward a reduction, continuation in status quo, or expansion of the Federal role in education, and whether the legislation, if any is needed, should be of one specific nature or another.

This question cannot be fully answered here. The answer is largely a matter of opinion on many points. In the following pages the writer discusses several of the broader implications, and summarizes other findings and conclusions from this study which are of significance in relation to legislative proposals.

C. NEED FOR LEGISLATION

Certain points bearing on the need have been pointed out: (1) The facts and opinions discovered in this investigation generally support the conclusion that the solution of the problem of trained manpower development is important to the national survival, and (2) there is a grave, national need for more and better training of technical and professional manpower. Little or no disagreement was found in the literature on these points, although someone has pointed out that "shortage" is a relative matter—that there may be, for example, a shortage of beautiful women.

These findings imply that there may be a need for new Federal and/or State legislation promotional to manpower training. If such a need exists, an implication that it calls for Federal action arises from the Federal responsibility for the national defense, the Federal concern for the general welfare, and the existing Federal administration of some educational programs and participation in others by the Federal Government. On the other hand, an implication that it calls for State and local action arises from the traditional, and constitutional, State and local responsibility for education in general.

This investigation has revealed widespread expressions of opinion that large new programs of Federal promotion of education are needed, with little published expression of opposition to most of these proposals. However, most of them have not been debated in Congress. Much opposition has been expressed to the proposal for Federal aid to school construction, now being widely considered both within and outside of Congress.

D. KIND OF LEGISLATION

A fundamental and outstanding conclusion from this study is that trained manpower development is basically an educational problem and that it runs wide and deep. It is not a problem merely of the shortage of scientists and engineers. It is a problem of trained manpower shortages in many fields. The national defense and the general welfare call for strengthening our entire system of education.

This implies that no single legislative measure, such as establishment of scholarships for science students, can be expected to do the

whole job. This does not imply that such a measure would be undesirable, although arguments have been advanced against Federal scholarships solely for science students. The conclusion is that there is no single cure-all for the shortages of trained manpower. If any legislation is needed a variety of legislation is needed. To be altogether successful, an attack upon the problem must be made not from a single approach but from a multiplicity of approaches. As a whole, the material covered by this study supports this conclusion.

Even for the production of scientists and engineers alone the problem involves education at all levels, in numerous subject fields, and in different kinds of institutions. It involves scholarships, public-school construction, equipment of colleges, salaries of teachers—everything relating to the financing and other problems of education in general.

Almost any measure which would advance education in the United States would promote the current or long-range development of scientific, engineering, and other professional manpower.

E. THE EMERGENCY ASPECT

The size of the educational task in the United States staggers the imagination. Evidence that the educational job is not being done are (1) the existing shortages of scientists, engineers, teachers, and other professional manpower, (2) shortages of subprofessional manpower, (3) dropouts of gifted students (potentially among the Nation's most valuable resources) from high school and college, and (4) (according to the Eisenhower administration) shortages of school buildings and equipment.

Unprecedented recent and prospective enrollment increases, the challenge of the Soviet Union to a life-or-death struggle for technical and economic supremacy, and other factors in the opinion of many people make the issue an emergency one.

These conditions have raised the question as to whether the Federal Government should institute new programs for the promotion of education on an emergency basis.

F. IMPLICATIONS FOR SPECIFIC PROPOSALS

With respect to specific legislative proposals, the implications of the data reported in this study and the conclusions therefrom are a matter of opinion.

For example, the finding reported by the United States Office of Education in 1957 (from data obtained from the States) that there is a continuing national shortage of school buildings is reported herein. In the opinion of some people this would imply a need for legislation providing Federal aid for school construction. Others might reject this current finding of need, or, accepting it, might consider that it should be met, not by Federal action, but by some other means. In this evidence of need, persons opposed to Federal aid to school construction on other grounds might see no implication for Federal legislation.

G. FINANCIAL AID TO STUDENTS

From the Federal legislative viewpoint, one of the principal components of the overall issue is the question of financial aid to students for higher education.

Greater public attention has been drawn to this issue by recent publicity given to what the Russians are doing. Many Americans have been startled to learn that in the Soviet Union the Central Government is not only providing free higher education to all qualified students, but is also paying a large percentage of them stipends which, at least for the better students in a number of fields, are comparable to industrial wages.

Numerous proposals for direct or indirect Federal aid to students for higher education have been advanced within the last several years. Generally, these have been expressed in bills.

This report contains a number of implications regarding such legislation. The following observations based upon the study are examples:

(1) A proposal for scholarships only for science and engineering students, or only in fields closely related to the national defense, has encountered opposition not only on the grounds already stated but also on the grounds that the Federal Government is already doing too much to promote education in these fields—unbalancing our educational system. Existing Federal educational programs are mainly connected with the national defense.

(2) Bills proposing scholarships for *gifted* and *needy* students in all fields, on a State-quota basis, enjoy a broader appeal, political and otherwise.

(3) In order to accomodate the expected great increases in enrollments, the colleges and universities themselves will require additional income not now in sight. Aid only to the institutions, however, would not assure getting enough of the Nation's most valuable human resources—its gifted youth—into college and keeping them there.

Other deductions concerning the issue of financial aid to students and closely related questions might be drawn from information given herein.

H. TEACHERS' SALARIES AND SCHOOL CONSTRUCTION

One of the most important conclusions from this study of current literature is that the shortage of technical and professional training in this country is largely due to the shortage of qualified teachers, which in turn is largely due to the low salaries of teachers.[32] This might seem to imply that, if the Congress is going to do anything to reduce the trained manpower shortages, it should enact legislation providing Federal aid for teachers' salaries. However, this proposal has been found to be highly controversial.

Proposals for Federal aid for the maintenance and operation of public schools in general, which would include payment of teachers' salaries, and proposals for Federal aid for teachers' salaries alone, have been introduced in Congress over a period of many years. After extensive consideration of such proposals then pending, the Congress put them aside several years ago and took up the school-construction issue, which seemed at that time to be less controversial.

Proponents of Federal aid for school construction have felt that it offers less basis for a claim that it would make possible a measure of

[32] Supporting material in ch. VI.

Federal control over education. Also the aid-for-construction proposal has been less involved with any question of aid for private schools, which bogged down the earlier proposals. However, the controversy over aid for school construction has been greatly increased because of involvement with the issue of racial segregation in schools.

The implication of findings from this study regarding teachers' salaries might be applied to school-construction aid to the extent that it might indirectly enable the States and localities to pay teachers more. However, the findings also have a direct bearing upon the school-construction question. Shortages of buildings and equipment undoubtedly have contributed to deficiencies in training of technical and professional manpower. Whether Federal aid should be provided to relieve the shortage of facilities is a question for Congress to answer.

I. AID FOR SUBPROFESSIONAL TRAINING

It has been pointed out that our shortage of scientists and engineers may not be as great as our shortage of technicians. Facts and opinions have been brought out in this report concerning the great emphasis upon subprofessional technical education in the Soviet Union. These facts and opinions are significant in relation to current proposals for further Federal promotion of vocational education below college grade in this country.[33]

A proposal that the Federal Government further participate in the support of the Nation's vocational (secondary) schools is contained in S. 1298, which was introduced on February 20, 1957, by Senator Lister Hill and 40 other Senators. This bill proposes to provide for the extension of vocational education to persons in areas where programs are not now fully developed or available, and for the development of vocational and technical education, including training and retraining made necessary by scientific and technological developments. This would be done by encouraging States to establish area vocational schools and programs for the training and retraining of technicians and skilled workers in industry and agriculture and for training in other occupations essential to the Nation's security and economy.

A full discussion of the arguments for and against this proposal is not within the province of this report. However, the facts and opinions brought out earlier are favorable toward this bill. It therefore seems fair to point out here that some persons feel there is an overemphasis on vocational education in this country to the relative neglect of other education important in our society.

In an address before the meeting of the Association of American Colleges at Philadelphia on January 8, 1957, President A. Whitney Griswold, of Yale University, discussed the cost of freedom. He said that the lives and writings of the founders of our country—

> proclaim the liberal arts as the educational source of the concepts of freedom embodied in the Constitution and the whole political philosophy of which it is the center.

He said, further, that—

> The inhibiting weakness of our educational system today is that it has not faithfully adhered to that philosophy. It has produced virtually unlimited oppor-

[33] There has been some dispute over the exact meaning of the term "vocational education below college grade."

tunities for training in the vocational skills required by our complex society but increasingly limited opportunities for contemplation of the meaning and purpose of those skills. It has allowed those studies which for centuries have been esteemed and sought after as the intellectual and spiritual sustenance of freemen and as the inspiration of a free society to become confused with other studies which, though useful in themselves, serve no such exalted—and essential—purpose, and to decline to a point well below their proper position in its curriculum.

J. CORPORATE SUPPORT OF HIGHER EDUCATION

Earlier in this chapter the conclusion was reached that, although many corporations are making important contributions to the financial support of higher education (mainly non-tax-supported higher education), corporate support of education does not pretend or promise a solution for many major problems of technical and professional manpower development—which begin with the first grade of elementary school, if not earlier.

This conclusion is significant in relation to the consideration of some legislative proposals. Recent publicity given to corporate support of higher education could lead to an overreliance upon it, with resultant less regard for these legislative proposals. It is important that persons considering the problem see corporate support in its proper relationship to the problem as a whole.

An important consideration in this connection is the question of whether control or influence over education would emanate from *any* major source of financial support. For many years one of the principal arguments advanced against various proposals for Federal "aid" to education has been that it would lead to Federal control. Many persons have also expressed the belief that expansion of corporate support of higher education will lead to *corporate* control—or at least undesirable corporate influence over education. Other persons have denied this, and a controversy over the possible extent of "big business" influence over education has developed.

If comparison is made between the possible effects of undue Federal Government influence as against the possible effects of undue corporation influence, then a point discussed earlier in this chapter is particularly significant—namely that the Federal Government interest in education presumably represents the national interest, whereas the corporation interest, perhaps for very good reasons, as currently evidenced, does not primarily represent such an interest. Should there be an alternative of markedly increased financial support of education by either the Federal Government *or* corporate concerns, these considerations enter the picture.

K. OTHER IMPLICATIONS

The foregoing are some of the broader implications for legislation which the writer sees in findings from this study. Other implications will be discovered by the discerning reader.

It is noteworthy here that some of the important considerations entering into the overall problem of trained manpower development do not relate directly to any broad, pending Federal legislative proposals. Examples of such matters are (1) the need for better utilization of the trained manpower we already have, perhaps particularly in the Armed Forces, and (2) the serious need for more and better voca-

tional guidance, including the identification and motivation of gifted students.

L. CONCLUSION—THE MAIN LEGISLATIVE QUESTION

The foregoing analysis has set forth and discussed a number of considerations entering into the technical and professional manpower development problem, and has drawn attention to some of the implications for legislation. The discussion has led back to the question with which it began. That is: What should be the future role of the Federal Government in the production of scientific, engineering, and other professional manpower; should that role be expanded, reduced, or continued without change?

Another way of asking the question is: Can, will, and should the States, localities, corporations and other private agencies, and individuals, finance education adequate for the Nation's needs without further aid, or with only the same amount or lesser aid from the Federal Government; and, if so, can and will they do the job *in time*.

This is the two-headed question of "Federal aid to education"—one of the most important and most controversial issues before the Congress. The answer must, of course, remain with Congress.

While all the material covered by this study has an important bearing on the issue (mainly as related to professional manpower development), this report does not review the arguments for and against any particular legislative proposition. However, two reports prepared in the Legislative Reference Service by this writer contain detailed arguments pro and con the two main Federal aid to education proposals before the Congress—assuming that aid to individuals for education is considered also to be aid to education. These reports deal respectively with "Federal Aid to Students for Higher Education" (printed June 1956) and "Federal Aid for School Construction" (printed February 1955).[34]

The arguments deal with the question of the ability of all the States to finance adequate educational programs, the question of whether lack of money is preventing many able students from attending college, et cetera. Many of the arguments (particularly those relating to the ability or lack of ability of the States to support education) would apply to almost any "Federal aid to education" proposal.

Our protection against the Communist masses and the deadly determination of their rulers to dominate the world involves the maintenance of our technological supremacy. This requires that we excel in quality of technological education. The maintenance of our form of government and our national progress require providing our whole population educational advantages in many fields of knowledge not required by the Communist dictatorship. Thus, we have a double educational task.

The first part of this report has sought to aid the Congress in determining whether under these circumstances there should be a change in the Federal role in education. The following chapters contain organized and summarized information which may further aid in the legislative decision.

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[34] Copies of the former are available to Members of Congress from the House Committee on Education and Labor. Copies of the latter are available to Members by loan from the Library of Congress.

PART II. HISTORICAL BACKGROUND

CHAPTER IV

HISTORY OF FEDERAL PARTICIPATION IN MANPOWER DEVELOPMENT

(With Emphasis Upon Policy and Precedent)

A. INTRODUCTION AND SUMMARY

The evolution of Federal policies affecting technical and professional manpower development is only partly separable from the history of Federal educational activities in general. However, a thorough study of that history from the viewpoint of its relationship to technical and professional training has revealed a number of policies and precedents of significance in that relationship. This one-chapter condensation of a long story emphasizes the establishment of such policies and precedents.

Several writers on the subject of Federal relations to education have correctly pointed out that the Federal Government has no basic policy governing what it should or should not do in the educational field. Here, neither the Constitution nor Federal law has established a blanket policy. However, Federal action—principally congressional action—through the years has created a number of policies and precedents which, taken together, may be considered to constitute an overall policy.

Another viewpoint might be that it has been the Federal policy to establish no general policy but to enact such measures as have appeared to be in the national interest at the time.

Some legislation of the last several years contains definite statements of policy respecting limited areas of activity or specific Federal educational programs.

As the importance of education to the national security and welfare has grown, the Federal Government has assumed increasing responsibilities in this field. No clear demarcation has been established between the Federal and State responsibilities, just as no clear line has been drawn between State and local responsibilities, in education. Through the years these responsibilities, as expressed in law, have overlapped and merged in varying degrees, in an ever-evolving process.

Study of the history of Federal activities in education leads, however, to the discernment of some evidence that there has been a general guiding principle for these activities. The Federal motivation to action appears generally to have been a (right or wrong) conclusion that the Federal Government should undertake whatever has needed to be done in the national interest but either could not or had not been done by the States and localities.

A similar philosophy has been suggested by President Eisenhower as a basis for determining the proper role of the Federal Government in general.

In one respect there has been a major change in Federal policy affecting manpower development at the higher educational level. Whereas formerly the general concept was that of Federal aid to States and institutions, within the past 40 years the policy has been largely that of Federal payment for services received. However, some of the older programs of Federal participation, such as further endowment and support of the land-grant colleges, have continued, and new grants to States, such as those for training in the field of public health, have been initiated. Proposals, not enacted, for new programs of both types—that is, measures based upon the "aid" and also the "payment for services" concepts—have been introduced in Congress within the last several years.

Some of the outstanding developments in the evolution of Federal policies affecting the training of technical and professional manpower have been the following:

1. Initiation of "general instruction" in the Army under the Von Steuben regulations of 1779. From this have developed the broad instructional programs of the Armed Forces, covering practically all subject fields, at all educational levels, for professional soldiers and other personnel.

2. Federal land-grants for the support of education, dating from 1785. These early grants initiated a policy of Federal aid to the Territories, and later to the States, for education.

3. Passage of the Morrill Act of 1862 providing for the endowment and support of land-grant colleges. This act established a precedent for Federal promotion of higher education in specified fields.

4. Creation of the United States Office of Education in 1867. That office has since performed important informational and service functions affecting the development of technical and professional manpower as well as education in general.

5. Initiation in 1879 of training by the Federal Government for some of its civilian employees. This activity has expanded through the years, and has included much technical and professional training.

6. Establishment of agricultural experiment stations under the Hatch Act of 1887. Federal promotion of agricultural research led to Federal promotion of research in other fields, eventually contributing to the professional training of thousands of individuals.

7. Passage of the Second Morrill Act in 1890. This started Federal money grants for instructional purposes in higher education.

8. Enactment of the Smith-Lever bill in 1914. Federal-State cooperation in extension work in agriculture and home economics was inaugurated by this act.

9. Passage of the Smith-Hughes Act in 1917. This initiated a policy of Federal cooperation with the States in support of vocational education below college grade.

10. Organization of the Reserve Officers Training Corps in 1916, amended in 1920. This was the first of several similar programs

involving cooperative educational undertakings by the Federal Government and civil institutions of higher education affecting the training of professional manpower.

11. Establishment of contractual arrangements between Federal agencies and educational institutions for the performance of research during World War I. The scope of these contracts has since been greatly broadened. Many graduate students now receive indirect Federal assistance through these contracts.

12. Large-scale Federal grants and loans in aid of education during the depression of the 1930's. These established precedents for Federal promotion of education in case of economics depression or other emergency.

13. Establishment of temporary Federal agencies to carry out educational programs during the depression. These could become models for similar agencies in any period regarded as a time of emergency.

14. Initiation of an exchange-of-persons program with 16 other American Republics under the treaty of Buenos Aires, 1936.

15. Initiation of vocational training for war production workers (below college grade) and engineering, science and management war training (college level) in 1940. These large-scale Federal programs continued to 1945.

16. Passage of the Servicemen's Readjustment Act of 1944. This established a policy of providing large-scale educational opportunities for veterans in general.

17. Approval of the Surplus Property Act of 1944. This initiated a policy of making available some Federal surplus property for educational use, thus indirectly aiding the training of technical and professional manpower.

18. Passage of the Fulbright Act of 1946. This instituted a new policy of educational exchanges with other countries which has contributed to the development of professional manpower of the United States and friendly nations.

19. Establishment of the National Science Foundation in 1950. This led to a large Federal fellowship program in the mathematical, physical, biological, engineering, and other sciences.

20. Formal recognition by the Congress in 1950 of partial Federal responsibility for construction and operation of schools in certain federally affected localities. Amendments to the 1950 legislation have not altered the basic policy.

21. Passage of Public Law 835, 84th Congress, in 1956. By providing grants for facilities for research in the health sciences this act will promote the advanced training of professional personnel in these sciences.

22. Appointment of the Committee on Education Beyond the High School and the National Committee for the Development of Scientists and Engineers, 1956. These appointments may lead to establishment of new Federal policies affecting the development of technical and professional manpower.

B. ORIGIN OF POLICIES

The origin of Federal policies currently affecting technical and professional manpower development antedates the Constitution. Assum-

ing a share of the responsibility for financing education, the Federal Government early undertook two types of activities: (1) operating educational programs of its own, and (2) aiding the Territories and later the States in financing education.

Apparently the National Government's own educational pursuits, as distinguished from aid to the States for education, began with "general instruction" in the Army under the Von Steuben regulations of 1779. This was the forerunner of Federal institutional establishments for training professional soldiers.

Aid to the Territories and States for education began soon thereafter. As early as in 1785 an ordinance adopted by the Congress of the Confederation concerning the disposal of public lands in the Western Territory reserved lot No. 16 of every township for the support of schools within that township. Two years later, in the Northwest Ordinance, the concept of education as being in part a national responsibility was expressed in the declaration that—

> Religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged.

With the admission of Ohio to the Union in 1802 Congress began setting aside public lands for school support at the time of admission of a State. By agreeing to the conditions of these grants the States endorsed this policy of Federal support for education. During the 19th century the Congress also made certain monetary grants to States which were frequently used to support education.

C. CONSTITUTIONAL PROVISIONS[1]

(Readers to whom the relationships of the Constitution to Federal educational activities are familiar might well skip the following four paragraphs. Others might find reading them initiatory to a consideration of the main theme of this chapter.)

The founders of our Republic recognized the essentiality of education of the people for the maintenance of popular government. At the time of the framing of the Constitution, however, a nationwide system of public educational institutions was only a distant hope of a few statesmen and reformers. Education was then regarded almost universally as being a parental and church function, and in America there was no established national church. Proposal for Federal administration of education would have immediately raised the question: Which church shall control it?

At one time during the Constitutional Convention, control over education was included in a list of specific powers being considered for assignment to the Federal Government, but the duty of administering education was among those items later deleted from the list. Since there was great difficulty in obtaining agreement on inescapable issues, the deletion of education may have been made to avoid raising a controversy which, because of the question of church control and for other reasons, would have been difficult if not impossible to resolve. Since the Constitution provided that powers not delegated to the Federal Government were reserved to the States, public educa-

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[1] Quattlebaum, C. A. Intergovernmental Relations in Administration of Education. I. Elementary and Secondary Education, the Educational Record, April 1955, p. 174.

tion *as it slowly developed during the 19th century* came under their control.

The "general welfare" clause and other clauses in the Constitution have served as warrants and guides for the development of Federal educational programs. In recent years there has been increasing contention that the "general welfare" clause assigned the Federal Government not simply the right but actually the duty to promote education. This is an ethical question which, by reason of its nature, has not been and is not likely to be the subject of any judicial decision. However, interpretations of the Constitution which have been made by the Supreme Court apparently would sanction appropriation of Federal funds for any activity in education which could be shown to be for the purpose of promoting the national welfare.[2]

D. MANPOWER FOR NATIONAL DEFENSE

Establishment of the Military Academy at West Point in 1802 might be considered the first Federal measure for the development of professional manpower. The Artillery Corps for Instruction, assembled at Fort Monroe, Va., in 1824, was the first of the special service schools later organized by all the major services of the Army for the training of officers. The Naval Academy was established at Annapolis in 1845; the Air Force Academy in 1954.

These establishments provide free higher education, plus other benefits for selected individuals, and constitute precedents for some current proposals aimed at professional manpower development. The Morrill Act of 1862 provided specifically that military training would be given at the land-grant colleges founded pursuant to that act.

Organization of the Reserve Officers Training Corps in 1916, the Student Army Training Corps in 1918, the Naval Reserve Officers Training Corps in 1925, and Air Force Reserve Officers Training Corps in 1946 marked important phases in cooperative educational undertakings by the Federal Government and civil institutions of higher education. The undertakings have required direct contracts with public and private colleges and universities. In the opinion of some persons the ROTC, AFROTC, and NROTC, and particularly the "Regular" NROTC established after World War II may be considered precedents for the creation of other Federal scholarship programs. The existing programs give aid to individuals for collegiate training particularly for military service. The Federal Departments provide instructors for the military courses, textbooks, and military equipment but no payments to the institutions for the use of facilities and other services in connection with the programs.

The ROTC programs have a distinct impact upon both the facilities and the finances of the colleges and universities. They also affect the educational programs which the colleges provide for students. The military instruction is broader than formerly and now includes much material of a nonmilitary nature.[3]

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[2] *Hamilton* v. *Regents* (1934), 297 U. S. 245; *Wickard* v. *Filburn* (1942), 317 U. S. 111; *Oklahoma* v. *U. S. Civil Service Commission* (1947), 330 U. S. 127.

[3] Blauch, Lloyd E. Higher Education and the Federal Government. Address before the American Council on Education, October 1956. Processed. 9 pp.

During World War II educational activities of all sorts and at all levels within the Armed Forces were vastly extended. At one time the Office of War Information announced that the United States Army and Navy were operating "the largest adult school system in the world." This system largely utilized the colleges and universities of the Nation.

Also during the Second World War the Congress made available to the States funds for a number of activities in education for national defense. The United States Office of Education administered several emergency programs and aids to education. These included (1) the "below college grade" program of vocational training for war production workers, and (2) the college level program of engineering, science, and management war training. Total Federal expenditures for these and other wartime training programs for civilians amounted to over $360 million.[4]

The United States Office of Education also administered a program of loans for students for training in technical and professional fields. This program is of particular interest today as a precedent for some bills pending in Congress.

From this whole account it may be seen that the Federal Government has developed a policy of large-scale provision for the training of manpower for national defense. Implementation of this policy involves direct utilization of a number of Federal institutions of higher education and also contractual utilization of the facilities and services of other public and private colleges and universities.

Provisions made by the Department of Defense for the education of Federal military and civilian personnel today include instruction in practically all subject fields at all educational levels.

E. LAND-GRANT COLLEGES AND MANPOWER DEVELOPMENT

With the passage of the Morrill Act of 1862 the Congress initiated a policy of aid to the States for the development of professional manpower in certain specialized fields. This act granted to each State Federal lands, or script to States in which there was not sufficient Federal land to make up their allotments. The proceeds of the sales of these grants were to provide for the endowment and support of at least one college in each State where the leading object would be—

> to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe.

Congress later enacted laws providing for continuing annual appropriations to these institutions.

The Second Morrill Act (1890) initiated Federal money grants for instructional purposes in higher education, specifying the use of the funds for certain subjects. This act set a pattern for other Federal subvention programs in education.

In 1914, through the Smith-Lever Act, Congress inaugurated a program of Federal-State cooperation in extension work in agriculture and home economics. This act and later acts providing for reforestation activities involve the services of land-grant colleges.

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[4] Blauch, Lloyd E. Federal Relations to Education. Encyclopedia of Educational Research, 1952, p. 440.

The Federal land-grant legislation represents development of a Federal policy of not only promoting higher education of the kind specified but also stimulating State support for this kind of education and concomitantly encouraging the training of professional manpower in general.

The land-grant institutions have been called "democracy's colleges" because of the tremendous impetus they gave to the expansion of higher education in this country. Giving support to instruction principally in agriculture, the mechanic arts, and military tactics, the grants have greatly influenced the general acceptance of natural science into the college curriculum.[5] They may be considered a precedent for Federal promotion of the application of science to agriculture and industry.

F. VOCATIONAL EDUCATION BELOW COLLEGE GRADE

Through the Smith-Hughes Act of 1917 the Congress established a policy of Federal aid to the States in the support of vocational education below college grade. The long-range effects of this program upon technical and professional manpower development in the affected fields have been beyond measure.

The Smith-Hughes Act provides a permanent annual appropriation of $7,138,000. It contains stipulations as to the use of the funds.

The act also provides aid for the training of teachers of vocational subjects. To this extent it constitutes a precedent for pending proposals for Federal subsidy of teacher training on a large scale.

Subsequent legislation culminating in the George-Barden Act of 1946 has authorized additional Federal appropriations and extended the scope of the Federal-State program of vocational education.

Beginning in 1940 and extending to the end of World War II, the Congress appropriated funds to the States for the training of defense and war production workers. The first appropriation of $15 million was increased annually until the amount exceeded $100 million. Under this program over 11 million people received training in occupations essential to the war effort.

The George-Barden Act authorized an appropriation of $29 million annually as the Federal share of financing the Federal-State program of vocational education. However, partly because large sums were made available to vocational education through the veterans' educational program initiated in 1946, Congress did not vote the full authorization under the George-Barden Act until 1956.

From 1950 to 1954, serious but unsuccessful efforts were made to reduce or eliminate the Federal appropriations for the program. However, its advocates rallied to its defense, and Congress reacted by voting an extra $5 million for 1955 and an additional $5 million increase for 1957.

The 84th Congress also enacted two bills which extended the scope of the program to include practical-nurse training and training for the fishing industry, and authorized appropriations for these purposes.

For 50 years some congressional leaders have contended that, since the efficiency of each individual worker adds up to the strength of

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[5] Miller, Helen A. Intergovernmental Relations in Administration of Education. II. Higher Education. The Educational Record, April 1955, p. 180.

the Nation, the Federal Government has a responsibility in the financing of vocational education. Each fight to maintain or increase Federal appropriations for the program appears to have resulted in strengthening it.[6] Long-range Federal promotion of technical and professional manpower development through grants to the States for vocational education appears to be a firmly established policy.

G. DEPRESSION-PERIOD PROGRAMS

During the depression of the 1930's certain Federal relief agencies engaged in educational activities while others provided grants and loans in aid of education. Through the Work Projects Administration and the Public Works Administration the Federal Government enabled educational institutions to renovate and construct facilities. Federal grants-in-aid to education and loans for the construction of educational buildings during this period amounted to many hundreds of millions of dollars.

The programs of the Civilian Conservation Corps and the National Youth Administration consisted largely of education and student assistance. In 1939, President Roosevelt said that the major purpose of the CCC was "to promote the welfare and further the training of the individuals" in the corps. In the same year he also said that the main purpose of the NYA was "to extend the educational opportunities of the youth of the country." Instruction in the CCC was generally below the collegiate level; however, many enrollees secured degrees by attending regular day or evening classes at colleges or universities near the camps.

The National Youth Administration also carried out activities of particular interest in the present study. While providing work relief, vocational guidance, and employment for persons between the ages of 16 and 25 years, the NYA operated an extensive student-aid program in secondary schools, colleges, and universities. Locally, school and college officials administered the program. These were responsible for assigning students suitable work and supervising the work done. Regional representatives of the NYA served in a liaison capacity between the State and National offices.

In case of another nationwide economic depression, these programs would stand as precedents for Federal action for the maintenance of training activities in all fields. Some persons consider that these programs constitute precedents for Federal action in any emergency period and regard the present as such an emergency.

H. MANPOWER DEVELOPMENT THROUGH RESEARCH

The Federal need for assistance and guidance in scientific study was formally recognized by the Congress through incorporation of the National Academy of Sciences. As a measure of national preparedness, the Academy organized the National Research Council in 1916.

Federal promotion of agricultural research began with passage of the Hatch Act of 1887 providing for an annual appropriation of $15,000 to each State or Territory for an agricultural experiment station under land-grant-college supervision.

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[6] Mobley, M. D., History of Federal Funds for Vocational Education. American Vocational Journal, December 1956, p. 98.

During World War I the Government began entering into contractual arrangements with colleges and universities for the performance of research activities in connection with national defense. Some arrangements of this kind were continued after the war. The scope of such research and the number of fields of investigation were greatly increased during World War II.

In the fiscal year 1957, the research programs of the Federal Government will involve expenditure of over $2\frac{1}{3}$ billion. A considerable percentage of this amount is going to colleges and universities through grants and contracts. Research grants and contract payments from the Public Health Service, the Department of Defense, and the Atomic Energy Commission to colleges, universities, hospitals, some private laboratories and research centers managed by universities will amount to over $300 million this year.

The Federal Government may be said to have developed a policy of broad utilization of the facilities and personnel of colleges and universities for research purposes.

This policy has made a large impact upon the higher education of numerous individuals. In 1952, the American Council on Education reported from a study of 32 colleges and universities that 14,000 people on their staffs were employed full time and part time on Government research.

While the affected institutions generally have been strengthened by the Federal contracts, in some cases the Federal payments have not met the full cost of the research. There have been complaints that the grants and contracts have not been fairly distributed geographically. There has also been dissatisfaction over the emphasis upon the natural sciences with little attention to the social sciences and humanities, and concern over the stress of applied and developmental rather than basic research.[7]

Altogether, the effects of the Federal research program upon technical and professional manpower development, though indirect, have been far reaching.

I. RESPONSIBILITIES OF THE OFFICE OF EDUCATION (DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE)

Consideration of the development of Federal policies affecting promotion of technical and professional manpower development must take into account the establishment of the United States Office of Education in 1867 and subsequent activities of that Office. It was established for the basic purpose of—

> Collecting such statistics and facts as shall show the condition and progress of education in the several States and Territories, and of diffusing such information respecting the organization and management of schools and school systems, and methods of teaching, as shall aid the people of the United States in the establishment and maintenance of efficient school systems and otherwise promote the cause of education throughout the country.

The collection and dissemination of information has remained a fundamental activity of the Office for the promotion of education at all levels. The Congress has at various times vested in the Office the

[7] Blauch, Lloyd E. Op. cit., p. 6.

responsibility for administering certain acts or programs, some temporary and some continuing, which affect technical and professional manpower training.

Soon after its establishment the Office of Education accepted the responsibility of auditing the public lands granted under the Morrill Act of 1862. It was later given and has since administered other responsibilities concerning the land-grant colleges and universities. Additional duties assigned to the Office of Education have included, for example, determination of the accrediting agencies which shall approve educational institutions for enrollment of veterans under Public Law 550, 82d Congress.

Although there has developed a Federal policy of assigning the Office of Education specific responsibilities, some of which have promoted the training of technical and professional manpower, these responsibilities have by no means included all those relating to Federal programs in this field. Only a small percentage of the total Federal expenditure for such activities has been channeled through the Office of Education. Some of the current activities of the Office of Education are discussed in the chapter of this report dealing with "Other Federal Contributions to Professional Manpower Development."

J. MANPOWER DEVELOPMENT THROUGH VETERANS' EDUCATION

The effects of the veterans' educational program upon the development of technical and professional manpower in the United States has been tremendous. In 1946 a publication by the American Council on Education predicted that GI education would be the most significant experiment in the whole history of higher education.[8] Ten years later another writer said that no other national program had ever given so many people so many skills in so many pursuits as did the GI bill.[9]

A Federal policy of providing rehabilitation training for disabled veterans dates from World War I. The Vocational Rehabilitation Act of 1943 and the Servicemen's Readjustment Act of 1944 established new educational programs respectively for disabled veterans and for veterans in general.

The act of 1943 provided vocational rehabilitation for disabled veterans of World War II found to be in need of such training. In 1950 the benefits of the act were extended to veterans disabled in Korea or elsewher under wartime conditions. Under this legislation the facilities of educational institutions and industrial establishments have been used to provide a wide variety of vocational and academic training. Tuition, books, supplies, equipment, necessary tools, and a subsistence allowance have been provided by the Veterans' Administration. The training load rose gradually from the initiation of the program to December 1947, when a peak number of about 256,000 disabled veterans was in training under this legislation.

The Servicemen's Readjustment Act of 1944, as amended, provided a broad, general educational program for veterans of World War II and subseqent service. Under the World War II legislation each honorably discharged veteran who had served 90 days or more in the armed services within certain specified dates, became eligible

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[8] Sharpe, Russell T., et al. Financial Assistance for College Students, 1946, p. 106.
[9] Stravinsky, Sam. What the GI Bill Did for America. American Legion magazine, June 1955, p. 14+.

to pursue an elected course in a certified institution of the veterans' choice for a period equal to that of his wartime service plus 1 year. The legislation provided for payment by the Veterans' Administration of the cost of tuition, books, and supplies, and a subsistence allowance varying with the number of veterans' dependents. When the peak training load under this program was reached in December 1947, over 2,500,000 veterans were enrolled in educational courses.

In the enactment of Public Law 550 the 82d Congress modified the Federal policy of providing veterans' educational benefits. Under the simplified system of allowance for subsistence, tuition, et cetera, the individual veteran became responsible for payments to the educational institution of his choice.

Altogether the veterans' education benefits programs have given financial assistance to millions of persons for technical, professional, and other training which they might not have obtained otherwise.

The result of allowing the beneficiaries of the program free choice of field of study, with the aid of competent counseling, has been significant. A study by the National Science Foundation, discussed later in this report,[10] has shown that a large percentage of the veterans have chosen training in sciences and engineering.

K. INTERNATIONAL EDUCATION AND MANPOWER DEVELOPMENT

The Federal programs of international educational exchange and technical assistance have contributed to the development of technical and professional manpower at home and in friendly foreign countries. These programs of cooperation with other nations in educational undertakings have been carried out as one phase of the foreign policy of the United States.

The Buenos Aires Treaty of 1936 initiated an exchange-of-persons program with 16 other American Republics. The 76th Congress expanded the program to include an exchange of students, teachers, and other persons with all of the other American Republics.

A new policy of aid to individuals to study abroad was established by the Fulbright Act of 1946. It augmented the existing educational exchange program by authorizing the Secretary of State to negotiate executive agreements providing for educational exchanges with foreign countries financed from the sale of surplus property abroad. The Smith-Mundt Act of 1948 furnished the basis for a worldwide program of educational exchanges.

These and other actions by the Congress and by the President have developed a definite policy of participation by the United States in international educational relations. The program has been concerned generally with college graduate and undergraduate students, primary and secondary schoolteachers, university lecturers, and advanced research scholars, specialists, and leaders of thought and opinion.

Executive Order 10610 of May 9, 1955, transferred to the International Cooperation Administration, a semiautonomous Agency under the Department of State, certain foreign-assistance activities formerly administered by the Foreign Operations Administration. Included was technical cooperation, consisting largely of demonstrations, teaching, training, exchange of information, and technical guidance. The program is aimed at helping less-developed areas of

[10] Chapter dealing with Federal aid to students.

the world to further their economic development and raise their standards of living, and involves education at all levels.

L. AID FOR INSTITUTIONS AND FACILITIES

Some of the earlier forms of Federal aid to non-Federal institutions of higher education have been pointed out in this discussion. A few others will be mentioned here.

In 1879 the Congress began making annual appropriations to Howard University, a privately controlled institution devoted primarily to the education of Negroes. Federal funds now constitute the main support of that institution.

An act of Congress in 1874 provided for the establishment of nautical schools at six designated ports, with State cooperation, for the training of officers for the merchant marine. An act of 1936 lead to the training of officers at Kings Point, Long Island, N. Y., and ultimately to legislation establishing the United States Merchant Marine Academy.

The Federal Government began assistance to college housing, on a temporary basis, under an extension of the Lanham Act of 1941. The Housing Act of 1950 and college housing amendments of 1955 provided for a continuing program of loans to colleges and universities for the construction of dormitories and other buildings.

An act of the 84th Congress initiated a 3-year, $90 million program of grants for the construction of research facilities for medical, dental, public health, and other nonprofit institutions.

During World War II the Federal Government accumulated a large quantity of real and personal property which later became surplus. In passing the Surplus Property Act of 1944, Congress initiated a policy of making available some of this property for educational usage. The Surplus Property Board and its successor, the War Assets Administration, with assistance from the United States Office of Education, determined distribution of such property to educational institutions on the basis of need. The institutions acquired some of the property through donation and some through purchase with discounts allowed for public benefit.

Subsequent legislation has augmented and extended the provisions for donations of Federal surplus property for educational and health purposes. This program of secondary utilization of Federal property by tax-supported or tax-exempt health and educational institutions is now recognized as one of the important Federal-aid programs. Surplus property acquired by colleges and universities during the fiscal year 1956 had a value of nearly $76 million.

The Federal policy of granting exemption from income taxation to nonproft institutions of higher education has given them important if indirect financial assistance.

Altogether, these policies and programs have markedly, though indirectly, promoted the training of technical and professional manpower.

M. SCHOLARSHIPS, FELLOWSHIPS, TRAINEESHIPS

The historic background of certain Federal programs regarded by some persons as scholarships has already been set forth in this chapter.

The Federal Government has also promoted manpower development through other fellowship and traineeship programs, particularly in the sciences.

The National Science Foundation Act of 1950 established the National Science Foundation for a number of purposes relating to the subject of this study. Among these has been: (1) Development and encouragement of a national policy for the promotion of basic research and education in the sciences; (2) awarding of scholarships and graduate fellowships in the sciences; and (3) providing a central clearinghouse for information covering scientific and technical personnel.

The Foundation inaugurated a fellowship program in the 1952–53 academic year, and through fiscal 1955 awarded a total of 1,920 fellowships.

Through grants for the support of basic scientific research the Foundation has indirectly supported a number of graduate and postdoctoral students performing research services for the grantees.

The Atomic Energy Commission was established by the Atomic Energy Act of 1946 as amended by the Atomic Energy Act of 1954. Under provisions of this legislation the Commission established small numbers of fellowships in radiological physics in 1948, in industrial medicine in 1949, and in industral hygiene in 1952.

Also of special interest in this study is the policy of granting research fellowship in fields of public health, initiated with the passage of the National Cancer Institute Act of 1937. As other national institutes of health have been activated they have established research fellowship and/or traineeship programs.

A recent development related to these programs was enactment of legislation by the 84th Congress providing graduate traineeships to increase the supply of public health specialists and add to the supply of professional nurses qualified to teach or supervise other nurses.

N. OTHER POLICIES AND PROGRAMS

Through the years the Federal Government has established a number of other poliices and programs affecting the training of technical and professional manpower.

For example, at least since 1879 the Federal Government has pursued a policy of providing training for some of its civilian employees. The program of technical training given its employees by the National Bureau of Standards dates from 1909. The Graduate School of the Department of Agriculture dates from 1920. Service and staff schools of Federal agencies have offered postsecondary instruction, sometimes in cooperation with colleges and universities. Some agencies have been authorized to provide inservice training for their personnel at private and State institutions. These programs have generally been aimed at meeting the need of the agencies for certain highly trained personnel.

In enacting the Vocational Rehabilitation Act of 1920 the Congress initiated a policy of Federal cooperation with the States in the vocational rehabilitation of persons disabled in industry. Amendments to the original act have expanded this policy by providing continuous and increased appropriations for this purpose. Administration of the program frequently utilizes colleges and universities, as well as

trade schools and other institutions, to meet the educational needs of disabled persons of employable age.

The long-range effects upon professional manpower development of recently established Federal policies at the levels of elementary and secondary education should not be disregarded.

In 1950, Public Laws 815 and 874, 81st Congress, gave recognition to the responsibility of the Federal Government for the impact of Federal activities respectively upon school-construction needs and upon the cost of operating schools in the localities in which such activities are carried out. In these acts the Congress declared it to be a policy of the Federal Government to bear the cost of constructing school facilities and to provide financial assistance to educational agencies in the affected areas in the manner and to the extent prescribed in the laws. In 1933 the Congress amended and extended this legislation but without change in the basic policy.

Within recent years a number of Federal commissions and committees, mostly Presidential, have made extensive studies and advanced recommendations relating to technical and professional manpower training.

For example, in 1947 the Commission on Higher Education which had been appointed by President Truman recommended establishment of a national scholarship and fellowship program. The President's Scientific Research Board, which also reported in 1947, recommended—

> a comprehensive Federal program for the assistance to undergraduate students * * * to pick up as the veterans' program declines.

The report of the Task Force on Public Welfare of the first Hoover Commission submitted to Congress in 1949, contained a recommendation favorable toward establishment of a Federal civilian scholarship system. The report of the (second) Hoover Commission in 1955 "centers primarily in the fields of elementary and secondary education." It stated that—

> Congress' power in the field of education is as broad as its discretion in spending for the public welfare—

but that—

> while the power may be sweeping, national conviction holds that education at the Federal level should be held to a demonstrable minimum.

The President's Committee on Education Beyond the High School and the National Committee for the Development of Scientists and Engineers, both appointed by President Eisenhower in April 1956, were assigned duties which may lead to the establishment of new Federal policies affecting the training of technical and professional manpower.

O. CONCLUSION

A complete history of the Federal role in the development of technical and professional manpower would be voluminous and appears unnecessary for the purposes of this study. From this 1-chapter analysis it may be seen that the Federal role has been one of wide and varying ramifications, but that certain policies and precedents are outstanding. These have been enumerated and commented upon in the introduction and summary of this chapter.

CHAPTER V

HISTORY OF STATE AND LOCAL ADMINISTRATION OF EDUCATION

(With Emphasis Upon Technical and Professional Training and Policy in Finance and Control)[1]

A. INTRODUCTION AND SUMMARY

From the beginning, the financing and administration of public education in the United States has been principally a function of the States and local communities rather than of the Federal Government. Nevertheless, the history of State and local activities in education is simpler in some respects than the story of the wide and varied ramifications of Federal activities in this field.

The development of technical and professional manpower has been an end product of State and local administration of education in general. However, by establishing State boards for vocational education, vocational secondary schools, and professional colleges, the States and localities have given particular emphasis to the training of technical and professional personnel.

The development of public support of education and of State control over it has been a slow and haphazard process resulting in lack of uniformity of State and local controls. In the financing and administration of public schools there has been a marked shift of responsibility from the local community to the State.

Despite Federal participation, vocational education has been mainly financed by the communities and States. In 1956 vocational education below college grade was supported by the local, State, and Federal Governments in the order of $2.44, $1.86, and $1, respectively. The States and localities have established machinery for making vocational education responsive to occupational trends.

Establishment of the land-grant colleges and universities gave great impetus to professional training in agriculture and engineering. These are State institutions and are mainly State supported. Other State universities, municipal colleges and universities, and public (community) junior colleges (some of which are partly supported from State revenues), are also making important contributions to professional training.

This chapter offers a cursory history of the State and local government roles in education, with a reexamination of basic policies from the viewpoint of these roles and with occasional references particularly to technical and professional training.

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[1] Principal source: Quattlebaum, Charles A., and Miller, Helen A., Intergovernmental Administration of Education, the Educational Record, April 1955, pp. 174–188. (Material originally prepared for the Commission on Intergovernment Relations). Some of the other sources used are indicated in footnotes.

B. BASIC POLICIES

The Constitution, Federal statutes, tradition, public opinion, and court decisions together have firmly established public education as principally a function and responsibility of the State governments rather than of the Federal Government. At the same time, the Constitution, Federal statutes, tradition, public opinion, and court decisions have given support to a diversity of Federal activities in education (including grants-in-aid to the States) undertaken on the claim of Federal responsibility for the national defense and for the promotion of the general welfare.

There is still a lack of general agreement concerning the exact proportions of responsibility for education borne by each of the several levels of government. While the long controversy over State versus local financing and control has waned (with State government responsibility in the ascendency), much of the argument over Federal aid to education bills in recent years has revolved around the question of the nature and degree of Federal responsibility for education.

Some expressions of opinion on the origin of basic policy in this field have reflected a general knowledge of the political history of the United States without an equal understanding of the history of education. In the preceding chapter it was pointed out that at the time of the framing of the Constitution education was almost universally regarded as a parental and church function. A keen insight into the effects of this public attitude upon the early development of basic governmental policies in education in the United States was expressed by Andrew Sloan Draper, then president of the University of Illinois, in a monograph prepared for the United States exhibit at the Paris Exposition of 1900. His statement on the subject reads in part as follows:

> What might have been done at the time of the framing of the Federal Constitution, if it had been supposed that in a few years the support and management of schools would develop into a governmental function, can only be speculated upon. It is well known that the members of the first Constitutional Convention were not indifferent to education. But their view of the subject was the view of all men of their time, i. e., that it was highly desirable that all social organizations should encourage, perhaps even by that time that it was proper for Government to see that schools were maintained, but that the real responsibility and, of course, the expense, should fall upon the people legally chargeable with the custody of children. *The functions of Government touching education were not then under consideration at all,* and when they (later) forced themselves upon public attention the towns, and when the exercise of the power of taxation became imperative, the States assumed them as they were bound to do. [Emphasis added.] [2]

Other authorities on the history of American education have supported Draper's explanation as to why the Constitution is silent on the subject of education. For example, in his widely accepted textbook on the history of education in the United States, Dr. Edgar W. Knight says:

> But the Constitution of the United States contains no mention of education; the subject was not debated, nor was it even seriously considered by the convention. The reasons are obvious. Schools were everywhere looked upon not as activities of the state (that is, of government) but as functions of the church, the family, or the individual. And the men who framed the Constitution were prod-

[2] Butler, Nicholas Murray (editor). Monographs on Education in the United States, Albany, N. Y., 1900, pp. 22–23.

ucts of the old aristocratic doctrine of education, of the theory that schools were intended for the leaders and for those who could afford the privilege of education.[3]

Two provisions of the Constitution have been outstanding among others that have served as guides to Federal-State relations in education.

Article I, section 8, says that:

> The Congress shall have power to lay and collect taxes, duties, imports and excises, to pay the debts, and provide for the common defense and general welfare of the United States. * * *

But the 10th amendment says:

> The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States, respectively, or to the people.

C. ELEMENTARY AND SECONDARY EDUCATION

1. Origin and development at the State level

Although during the early history of the United States there was little or no general interest in education as a function of government, there were, however, some discussions of the subject.

Several years after he had written the Declaration of Independence, Thomas Jefferson devised a plan for the legislative establishment of public schools in Virginia.

It is significant that the plan was based upon his theories of local self-government. However, there were at that time many obstacles to the establishment, in any State, of the foundations for free, universal public schools such as those now in operation in all the States.

The concept of education as a function of government gradually spread during the first half of the 19th century. However, as Knight pointed out:

> Knowledge and learning which Jefferson a century earlier had sought by legislative action to diffuse more generally among the people of his State, were still strange to most of the people of the United States when Andrew Jackson was President.[4]

The development of public support of education was a slow process, and the growth of the principle of State control was long and hazardous. The result is a lack of uniformity in State and local controls.

The States early began to regulate and later more fully to administer education within their borders. An act of the New York Legislature in 1812 gave recognition to the principle of State control of the schools, and provided for the appointment of a State "superintendent of the common schools." The act also made provision for school district organization, and established some guiding principles for education. For decades, however, the States generally were inclined to delegate to local school boards the power to control all aspects of local educational activity. This included the licensing of teachers and selection of textbooks.

In Massachusetts for example, the State began by (1) providing legal sanctions for the district school system, (2) granting the districts power to levy taxes for local support of schools, and (3) giving

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[3] Knight, Edgar W. Education in the United States. New York, Ginn & Co., 1941, p. 143.

[4] Knight, Edgar W. *Op. cit.*, p. 186.

the school districts a legal status which made them independent of both the State government and other governmental units.

"The little red schoolhouse" came to epitomize for the American people all that they considered desirable in the tradition of American education.

During the second quarter of the nineteenth century the general trend toward decentralization started reversing. As the population rapidly increased, the people began to feel that the State should assume more responsibility for education. It became apparent that the State could provide greater financial support and more competent leadership. Generally, people saw that the State was in a position to estabilsh broad policies for education.

Wishing to retain their independence, local school districts for some time challenged the authority of the States. However, the courts consistently upheld the State responsibility for education.[5]

In the 1830's the Legislatures of Massachusetts and Connecticut established State boards of education. Appointment of two remarkably influential men, Horace Mann and Henry Barnard, as secretaries to these boards, respectively, stimulated the movement toward centralization of educational authority in the State. There has since been a slow but gradual increase in State responsibility for the administration and financing of public schools.

Outstanding developments in State administration of elementary and secondary education since 1900 have been: (1) provisions for the improvement of the administrative structure; (2) measures for the improvement of the status of teachers; and (3) increase of State aid to local school districts.

2. Origin and development at the local level

No other aspect of American life has more clearly demonstrated the operation of grassroots democracy than the local administration of schools.

In the early history of the Republic the organization of local school districts was a natural result of the geographical, religious, and political conditions of the time. The difficulties of transportation and communication and religious differences made provision for education from a distant seat of authority unsatisfactory. Residents of new settlements everywhere established their own schools—usually at first connected with their churches. As the concept of publicly financed, nonsectarian schools developed in the East, migrants to the West took with them their ideals of local administration of such schools. Thus the people established the system of local school districts which today blankets the Nation.

However, with the improvement of transportation in recent years, reorganization of school districts has been a continuous process. By pooling their resources, in numerous instances communities have made available better school housing, equipment, and teaching for all their children. Generally State governments, and in some cases the Federal Government, have provided aid toward the construction and operation of the new schools.

The early American colonists gave their town councils responsibility for overseeing education. As the towns grew, the increased educa-

[5] Lee, Gordon C. An Introduction to Education in Modern America. New York, Henry Holt & Co., 1953, p. 224.

tional responsibilities were taken over by special committees of the councils. By the latter part of the 18th century these committees had in many instances gained such independence and prestige as to become separate boards of education or "trustees" for the schools. With the development of State authority over education in the 19th century, the State legislatures began to enact laws requiring local school districts to maintain lay boards for supervision over the local administration of education.

As the duties of school administration grew in complexity, the local school boards started employing professional educators to administer their schools. Thus the now prevalent position of the school executive came into existence. For some years it has been common practice for the school board and the school administrator and his assistants to work out policies and procedures for the local administration of elementary and secondary education. The decisions have affected vocational training in the local school system and the degree of emphasis given to the teaching of particular subjects, such as mathematics. The superintendent has been largely responsible for the determination of local policies in such matters.

In recent years the larger school systems have generally employed persons especially trained for the vocational counseling of students. These persons are playing an important role in the discovery and guidance of students competent to undertake training for professional careers.

3. Intergovernmental relations

For over a hundred years the financing and administration of public elementary and secondary education in the United States have been carried out principally as a cooperative undertaking by the State and local governments. The shifting of the responsibility from local to State governments, however, has been definite and pronounced. It has proceeded at an accelerated rate within the last several decades.

The report submitted to the Commission on Intergovernmental Relations,[6] by its study committee on responsibility in the field of education dated June 1955, contains the following statement summarizing the shifts in that responsibility during the history of the Republic.

> In the three centuries of our growth there have been several shifts in the patterns of responsibility for the conduct of education. In colonial times and the early days of the Republic, voluntary secular groups, religious bodies, and the family were largely responsible for maintenance of schools and imparting knowledge to new generations. While each of these elements is still significant in our total effort, for more than a century the role of the public agency has become increasingly important in the total undertaking.
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> This shift from private to public responsibility was followed by a redistribution of relative responsibility between the local community and the States. With the general acceptance of universal education during the 19th century, and the vast expansion of school programs in the 20th century, State governments were obliged to take an increasing interest in providing guidance and leadership in setting up minimum standards and in assuming a growing share of the financial support of the economically disparate local communities. Later, changes in technology brought about a shift in the incidence of the market, of community consciousness, and of public opinion. With this trend toward a new sense of a national community came a corresponding growth of Federal participation in education. These programs, designed for different purposes and involving

[6] Established pursuant to Public Law 107, approved July 10, 1953.

varying degrees of Federal control, provided a considerable amount of controversy. The issues implicit in that dispute provide the focus for this inquiry.

These changes in the distribution of responsibility for education have been accompanied in the later years by a revolution in fiscal policy. The Federal Government has assumed sources of tax funds formerly available to States and localities. Whereas 20 years ago State and local government tax collections constituted three-fourths of all tax collections in the United States, today the Federal Government receives and dispenses three-fourths of the total. While stemming from circumstances outside of the educational system, this trend in the Nation's fiscal structure has necessarily materially affected the general redistribution of educational responsibility.[7]

In its report to the President, dated June 20, 1955, the Commission on Intergovernmental Relations, made the following recommendation respecting the continuation of State responsibility for education:[8]

The Commission recommends that responsibility for providing general public education continue to rest squarely upon the States and their political subdivisions. The Commission does not recommend a general program of Federal financial assistance to elementary and secondary education, believing that the States have the capacity to meet their educational requirements. However, where, upon a clear factual finding of need and lack of resources, it is demonstrated that one or more States do not have sufficient tax resources to support an adequate school system, the National Government, through some appropriate means, would be justified in assisting such States temporarily in financing the construction of school facilities—exercising particular caution to avoid interference by the National Government in educational processes or programs.

The following members of the Commission dissented to this recommendation: Senators Hubert H. Humphrey and Wayne Morse and Representative John D. Dingell. Their dissenting statement reads as follows:[9]

We see no objection in principle and no sound reason to fear Federal aid for school construction or for the support of general elementary and secondary education. We believe that the needs of the Nation for an educated citizenry and the just claims of every child to a fair chance to get an adequate education outweight the arguments in favor of complete State and local support for education.

Congress recognized the interest of the National Government in the problems of school construction by passing Public Law 815 in 1950. Pursuant to the authority of this act, the Office of Education conducted a comprehensive survey concluding that there was a nationwide need for 312,000 additional classrooms in 1952 to house nearly 9 million pupils at a cost of about $10.6 billion. Moreover, in the next 5 years, it is estimated that approximately 720,000 public elementary and secondary classrooms and related facilities will be needed at an estimated cost of about $28 billion.

We agree with the Commission's recognition of the paramount importance of education to the national interest. In view of this importance, we do not feel that the solution to the urgent education needs should be postponed until the States correct their economic and constitutional limitations. We do not believe the Commission is justified in establishing a more rigid standard for a Federal grant-in-aid program in education than it has applied to other programs of lesser importance to the national interest.

In provisions for secondary vocational courses basic to professional training in science, engineering, and some other fields, Federal, State, and local relationships have been particularly close. All three levels of government have contributed to the program of vocational education carried out under the Smith-Hughes and George-Barden acts.

This program started out with State-local matching of Federal funds, but the State-local percentage of support has markedly in-

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[7] Study Committee Report on Federal Responsibility in the Feld of Education submitted to the Commission on Intergovernmental Relations, June 1955, p. 16.
[8] Report of the Commission, p. 194.
[9] Ibid., pp. 195, 196.

creased. In fiscal 1956 the State-local contribution, for the country as a whole, was $4.30 for each dollar of Federal funds—$2.44 of the $4.30 was local money and $1.86 was State money. Thus, in 1956, this job might be considered as having been done financially by the local, State, and Federal governments in the order of $2.44, $1.86, and $1, respectively.[10]

Basic in the philosophy of vocational education is the belief that it should be founded upon a job analysis of the occupations in which the training is to be given. The States and communities have together set up machinery for making such analyses responsive to changes in occupational trends. Generally State and local people connected with vocational education have shown sensitivity to the changing needs for manpower in the various fields in which training is given. An evidence of such sensitivity has been the increasing use of advisory groups including representatives of management and labor.

D. HIGHER EDUCATION

1. The States and higher education

Generally the colonial governments and early State governments nurtured the private colleges within their jurisdictions. However, the constitutions of some of the States provided for institutions of higher education, which these States soon established.

Each of two State universities has claimed, on different grounds, to be the oldest in the United States. The University of Georgia was chartered in 1785, but it did not open until 1800. The University of North Carolina was chartered in 1789 and opened in 1795.[11]

Grants of land from the Federal Government aided the establishment of many of the 21 State universities which antedate the Civil war.[12]

All of the State-supported institutions of higher education grew slowly. Most of them did not receive very encourging support from State legislatures until after the Civil War. The devastation from invasion and the travails of reconstruction in the South delayed the growth of the institutions in that area, but generally the universities began to flourish with the return of peace.

About 1885 the State universities began turning their attention to serving and advancing the welfare of the State. By 1900 they were becoming truly service institutions in a democratic society. Since then enrollments at the State universities have grown by leaps and bounds. The States have put many millions of dollars into these institutions—

> believing in them as the creators of advanced public opinion and as training schools for the future leaders of the State.[13]

The land-grant college movement initiated by the Morrill Act of 1862 brought higher education closer to the needs of the people. In

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[10] Data compiled in the U. S. Office of Education from the annual reports of State board for vocational education. Figures do not generally include overhead costs such as those for equipment, heat, light, etc.

[11] The "University of the State of New York" was established in 1784 as a supervisory body for all education in that State, private and public. The State Education Department is a part of this organization. New York has no single institution designated as its university. The Encyclopedia Americana, 1952, vol. XXV, pp. 525–526.

[12] American Council on Education. American Universities and Colleges, 1956, p. 14.

[13] Encyclopaedia Britannica, 1952, vol. 7, p. 995.

an address delivered in Washington on April 4, 1957, President Eisenhower referred to the State and local support and direction of these institutions. He said:

> * * * I remind you that the great colleges and universities that sprang up under Lincoln's college land-grant bill were not Federal projects. By no means. Most of the capital and organization for these institutions was provided by the States themselves.
>
> * * * * * * *
>
> At present, the land-grant colleges and universities receive most of their support and all of their direction from local citizens.[14]

Public provision for the training of teachers in secondary-level academies began with the founding by Massachusetts of a State Normal School in 1839. Other States also established such institutions. In 1855 the State University of Iowa established the first chair of education still in existence.[15] Generally the teachers' colleges of today developed out of the old normal schools.[16]

Little attention was given to technical education until after the Civil War. The Massachusetts Institute of Technology opened in 1865. After the launching of the land-grant college program the States began establishing institutions or new departments in existing institutions in the several branches of engineering.

Recognizing the increasing importance of education in all fields, some States have established professional schools of medicine and institutions for training in other professional fields besides those already mentioned.

Besides providing for a variety of public institutions of higher education, the States have granted private colleges and universities a number of privileges and exemptions.

State financing and administration of higher education has been an evolving process. In recent years changes in State government organization and machinery have markedly affected higher education in most of the States. Generally there has been a tendency toward a closer relationship of the State institutions of higher education to the State government, with more centralized financial supervision.

2. Local administration of higher education

Local government administration of higher education in the United States began modestly, with municipal institutions. Only 2 of the 20 municipally controlled colleges and universities now in operation were established prior to 1860. The oldest is the College of Charleston, in Charleston, S. C. Chartered in 1785 as a private institution, it became a municipal institution in 1837. The second oldest is City College, which was founded in 1849—the first of four units of the college of the city of New York. By providing free or low-cost higher education to local residents, municipal colleges and universities have enabled many persons to obtain academic degrees who might not otherwise have been able to do so.

In 1892 a new idea in education was introduced at the University of Chicago with organization of the Liberal Arts College into an upper and lower division. In 1896 the lower division was given the name

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[14] Text of President's address to the National Education Association. New York Times, April 5, 1957, p. 16.
[15] The Council of State Governments. Higher Education in the Forty-eight States, 1952, pp. 16–17.
[16] Encyclopaedia Americana, 1952, vol. 9, p. 623.

"Junior College". This term came into widespread use when the California Legislature authorized the establishment of junior colleges in the public-school system.

One of the most important developments in education in the 20th century has been the growth of public junior colleges throughout the Nation. This development has been largely in response to the demands of modern technology. It has been stimulated also by a growing public respect for education beyond the high school. These and other influences have increased the demand for local provision of education at least at the junior-college level.

The increase in numbers of junior colleges within the last few decades has been phenomenal. In 1915 there were only 19 public institutions of this kind, with a total enrollment of 592 students. By 1927 there were 136 public junior colleges enrolling 20,145 persons. The American Association of Junior Colleges has currently listed 363 public junior colleges with a combined enrollment of 683,129 students.[17]

While some of these institutions are maintained by the States, the majority are operated by cities and school districts in close connection with the public high schools.

Over half of the State legislatures have passed laws affecting public junior colleges. Some of these measures have provided specifically for local administration of these institutions, and the legislation in most of the other States generally implies local administration of the junior colleges.

In at least 13 States—Arizona, California, Colorado, Florida, Idaho, Illinois, Iowa, Michigan, Mississippi, Missouri, New York, Texas, and Washington—public junior colleges are supported in part from "State aid", that is from State sources of revenue. Generally States have established certain prerequisites for the receipt of this assistance. In some cases the requirements are minor, such as the submission of an annual report to the State superintendent of public instruction or the average daily attendance of a specified number of students taking college-grade courses. Such requirements, of course, represent some measure of State control over the institutions.

Most junior colleges have a stated philosophy of seeking to bring free, or practically free education to the students they enroll. The common practice is nevertheless to charge students tuition or general fees. State laws are generally silent on this matter or else are permissive to the charging of student fees. However, in spite of charging such fees the public junior colleges, like the municipal degree-granting institutions, probably are providing post-secondary education to many young people who would be unable to live away from home or for other reasons would not live away from home, to obtain it. By adjusting their program to local needs and to the needs of the large percentage of their students who will terminate their higher education locally, and by emphasizing vocational education, America's locally controlled junior colleges are making a major contribution to the development of technical and professional manpower.

3. Intergovernmental relations

Generally the municipal degree-granting colleges and universities have been administered by the municipalities quite independently of State authority.

[17] American Association of Junior Colleges, Junior College Directory, 1957, p. 4. U. S. Office of Education figures are lower, making certain exclusions.

The variations of State-local relationships in the financing and control of public junior colleges have been highlighted in the preceding historical sketch. The following list of types of special legislation affecting junior colleges that have been enacted by 20 States will further illustrate the variety of such relationships between the State and local governments.[18]

Type of legislation	*State*
Established specific, State-controlled, junior colleges.	Arkansas, New Mexico, New York, North Dakota, Oklahoma, Texas, Utah, and West Virginia.
Authorized junior colleges to be established as a part of, or to become part of, the State university or State system of higher education.	Georgia, Louisiana, Montana, New York, Oregon, Pennsylvania, Tennessee, Virginia, and Wisconsin.
Authorized establishment of specific, local public junior colleges.	Georgia, North Carolina.
Converted a 4-year university to a quasi-public junior college.	Indiana.
Appropriated State funds to support a specific private institution.	Maine.
Appropriated a special fund in budget of State public schools for junior college purposes.	Maryland.
Established area college centers to meet emergency need for education of veterans.	Pennsylvania.
Authorized counties to provide physical plant facilities for State university extension centers.	Wisconsin.

In many instances public degree-granting colleges and universities in different States have entered into bilaterial agreements for the establishment of stronger academic programs. Several interstate compacts have also been formed for this purpose. The first of these was the Southern Regional Board compact of 1948.

Some of the Federal-State relationships in higher education have been pointed out in the preceding chapter dealing with the history of Federal participation in manpower development. Generally Federal-State-local relations in this field have been on the basis of the principle of Federal aid. On the other hand, the Federal Government has been largely dependent upon the State and local governments to make provisions for the training of scientific, engineering, and other professional manpower adequate for the national needs.

Throughout the history of the country there has been little shifting of responsibility for public higher education among the several levels of Government. That responsibility has been continuously discharged principally by the State and local governments, and principally remains in them.

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[18] Bogne, Jesse P. (editor). American Junior Colleges. American Council on Education, 1956, p. 28.

PART III. DIGEST OF STATISTICS AND OPINIONS

CHAPTER VI

DIGEST OF RELEVANT STATISTICAL STUDIES

A. INTRODUCTION AND SUMMARY

A detailed, mainly statistical, report on Engineering and Scientific Manpower in the United States, Western Europe, and Soviet Russia; prepared in the Legislative Reference Service by Harris Collingwood, was printed in March 1956, for the use of the Joint Committee on Atomic Energy. That report contains data from identified sources, for periods as recent as the academic year 1954–55, with some estimates and projections for later years.

Beginning with a digest of that report, this chapter brings together, digests and summarizes other selected, statistical studies, mostly published in 1956, relating to various aspects of the technical and professional manpower development problem. The chapter also points out some of the implications of these studies in relation to the problem.

The total statistical picture is not entirely clear, because neither the reports here reviewed nor some others bearing on the subject are altogether in agreement, and none of the studies is fully comprehensive of the whole issue. More extensive original investigation would be required to highlight all of the statistical facets of the complicated technical and professional manpower development question.

It is the purpose of this chapter summary to impart a general conception of some of the various aspects of the situation as they appear from the research reports here considered.

United States-U. S. S. R. comparisons.—According to data contained in the aforementioned report by Harris Collingwood, at the end of 1955 Soviet Russia had about 800,000 graduate engineers and scientists—a greater number than the United States, and more than three-fourths the number in the United States and Western European nations together. In 1954 Soviet Russia graduated 103,000 scientists and engineers, about 7,000 more than the United States and 15 countries of Western Europe. In 1955 there were about 3,190,000 students enrolled in Soviet institutions of higher education as against approximately 2,795,000 in the United States. The enrollment of 226,000 engineering students in Soviet institutions contrasted with the enrollment of only 156,000 in the United States.

According to a report published by the National Science Foundation in August 1956, living graduates in all scientific fields in 1955 numbered 1,536,000 in the United States and 1,158,000 in the U. S. S. R. These figures included 575,000 engineers in the United

States and 555,000 engineers in the U. S. S. R. Science field graduates in 1955 numbered 59,000 in the United States and 126,000—over twice as many—in the U. S. S. R. In the United States 22,600 of the science graduates of that year are engineers, and in the U. S. S. R. 59,000 of the 1955 science graduates are engineers.

(For information concerning the different sources of these data, the reader is referred to the two identified reports, which are available to Members of Congress.)

Need for scientists.—A study made by the B. F. Goodrich Co. in 1956 led to the conclusion that we will still have a shortage of about 100,000 scientists and engineers in 1967, unless steps are taken to boost the present rates of graduation.

Demand for engineers.—A survey by the Engineers Joint Council indicated a rise in demand for technicians and for engineering graduates in 1956 substantially greater than in any other year since 1951.

Employment of scientists.—A National Science Foundation study published in 1956 showed the employment profile of more than 94,000 scientists in the National Register of Scientific and Technical Personnel in the academic years 1954–55 was: (1) More than 92 percent of the scientists employed; 3 percent on active military duty; and the remaining 5 percent engaged as full-time graduate students, retired, or for other reasons not employed. The annual professional salary of only half of the employed scientists was more than $6,525.

Trends in employment and training.—In 1956 the National Science Foundation reported findings from a study of trends in employment and training, including these: Workers in science and technology are a relatively small but rapidly growing segment of the labor force.

Needs for highly trained scientists and engineers may exceed even the anticipated increase in graduations.

High-school enrollments in science and mathematics.—The United States Office of Education has labeled "erroneous" some recent public statements concerning the paucity of study of science and mathematics in the Nation's high schools. The Office has published data showing larger enrollments in these fields but has pointed out that the data do not imply that the number of students pursuing mathematics and science courses is sufficient.

Career choice by top students.—Data collected by the National Association of Secondary School Principals indicate that relatively large numbers of high school seniors ranking high scholastically are choosing careers in fields in which there are national shortages of personnel, but that the figures do not offer great hope for reduction of the teacher shortage.

College enrollments and degrees.—In 1956 the United States Office of Education published data leading to conclusions, among others, that: (1) Students are not being attracted to teaching and engineering in the numbers desirable, and (2) the larger increases in engineering enrollments within the last several years may not be large enough to provide a prompt solution to the problem of the engineer shortage.

***College enrollment plans.*—In December 1956 the Association of American Colleges reported data showing, among other things, that: A 20-percent increase in enrollment is all that can be expected of 4-year liberal arts colleges in the next 5 years unless they obtain speedy and substantial increases in financial support not now foreseen.**

***Teacher supply and demand.*—The National Educational Association has published data showing an expected shortage of 180,000 qualified elementary and high-school teachers in the school year 1956–57. Data compiled by the association concerning the teacher supply and demand in degree-granting institutions indicated shortages in all teaching fields, but particularly in the physical sciences and in mathematics.**

***Teacher's salaries.*—In a 1956 publication containing data on college teacher's salaries the Research Division of the National Education Association drew attention to low salaries as the principal contributing cause of the teacher shortage in general. The publication gave the median annual salary for all college teachers in the representative group studied as being $5,243.**

***Other studies.*—Among findings of other research studies relating to the question of technical and professional manpower development are: The Nation is producing enough persons competent for higher education to meet the demands for specialization in all fields. Provision for sufficient number of scholarships would probably cause three-fourths instead of only one-half of the top 27 percent of high school graduates to enter college. The principal reason for college dropout after the first year is financial difficulties. The GI bill turned out to be a wise investment in the Nation's most important resource—people.**

B. ENGINEERING AND SCIENTIFIC MANPOWER

Following is a digest of the Collingwood report, identified earlier in this chapter.

As of the end of 1955, the United States had between 710,000 and 760,000 graduate engineers and scientists; and the United States and the countries of Western Europe together had between 1,135,000 and 1,195,000 graduates and persons of comparable training in science and engineering. It is estimated that Russia has about 800,000—a greater number than the United States, and more than three-fourths the number in the United States and Western European countries combined.

In 1954, the colleges and universities of the United States granted first professional or bachelor's degrees to 22,236 in engineering, and 31,168 in the science subjects grouped under agriculture, biology, mathematics, and the physical sciences. Degrees in engineering may reach 50,000 by 1964, but meanwhile civilian and military needs are steadily increasing. Even now, to replace normal losses, provide for research and for expected technical discoveries, and to maintain a state of partial mobilization for defense, the United States needs between 30,000 to 39,000 new engineers each year. The Western European countries will need about the same number. Nowhere in the free world are these needs being met, nor have they been met during the last 4 or 5 years.

In 1954 accredited colleges and universities in the United States and 15 countries of Western Europe graduated 51,262 new engineers against a need for 65,000 to 75,000. In the same year Soviet institutions graduated 53,000. In 1954 the United States and Western Europe produced 45,502 new scientists other than engineers, while Soviet institutions graduated 50,000. The combination of these 2 groups gave Soviet Russia 103,000 new engineers and scientists or about 7,000 more than the number graduated from colleges and universities in the United States and Western Europe in that year.

Allen W. Dulles, Director of the Central Intelligence Agency, has predicted that for the years 1950–60 the Soviets will graduate 1,200,000 in the sciences, while the United States will graduate 900,000. This supports Representative Melvin Price, chairman of the Subcommittee on Research and Development, Joint Committee on Atomic Energy, who warns: "From here on, the Russians show promise of widening the difference—and to our disadvantage."

There are altogether about 3,190,000 students enrolled in some 4,900 Soviet institutions of higher education as contrasted with 2,794,708 students enrolled in 1,678 colleges and universities in the United States and Western Europe. The 266,000 engineering students enrolled in Soviet institutions are in sharp contrast to the 156,000 in United States institutions.

The training given Soviet engineers and scientists compares favorably with the best in the United States and Europe. Doctrinal domination of technical education, rigidity of subject matter and stereotyped teaching appear as weaknesses in the Soviet system. In contrast to this the United States is suffering declines in the teaching of physical sciences in secondary schools, loss of enrollment between high school and college, and dropout of able students after college entrance and prior to graduation.

Among the remedies which have been urged, consideration may be given to those by President John T. Rettaliata of the Illinois Institute of Technology. He proposes an immediate adjustment of high school programs to meet the requirements of accredited colleges of science and engineering, more effective high school counseling on the advantages of a college education, more scholarships for worthy students, expanded use of laboratory classroom facilities now available in the colleges and universities, and further adjustments on the military draft policies as they affect college students.[1]

In achieving these and other means of correction and improvement, Representative Price has declared that:

> The emphasis must be on Federal leadership because nothing else will do. Only the Federal Government has the resources and prestige to produce a swift new emphasis on the training of an adequate number of qualified young people in the engineering and scientific fields.

C. UNITED STATES—U. S. S. R. SCIENTIFIC PERSONNEL

On August 3, 1956, the National Science Foundation issued comparative figures on United States-U. S. S. R. scientific personnel. Among other findings, the Foundation reported that:

More than twice as many students in science fields were graduated in the Soviet Union in 1955 as were graduated in the United States.

[1] U. S. Congress, Joint Committee on Atomic Energy. Engineering and Scientific Manpower in the United States, Western Europe, and Soviet Russia (84th Cong., 2d sess., Joint Committee print, March 1956, 85 pages).

Science field graduates in the Soviet Union totaled 126,000, of which 59,000 graduates were in engineering. In the United States the total was 59,000 science field graduates, of which 22,589 were in engineering.

In issuing these estimates, the Director of the National Science Foundation warned that such overall comparisons of scientific personnel in the two countries should be viewed with caution. He pointed out that—

> The people represented by the data under discussion live in vastly different social, political, and economical frameworks. The figures themselves are drawn from different demographic bases. These differences result, not only in different kinds of training in the two countries and in subsequent utilization of trained personnel, but they also result in intangible individual differences that do not lend themselves to comparison.

The following data compiled by the Foundation compare in very broad terms the number of scientific personnel in the two countries.

Comparison between United States and U. S. S. R. scientific personnel

United States	U. S. S. R.
1. Living graduates in all scientific fields (with first-level degrees), 1955: 1,536,000 (natural science, psychology, agriculture, and engineering) of which— 575,00 were engineers	1. Living graduates in all scientific fields (roughly equivalent to our first-level degree), 1955: 1,158,000 (engineering, agriculture, science teachers, university graduates in science, and other science) of which— 555,000 were engineers (535,000 engineers by rigid criteria—excludes 31,000 others included below—20,000 agricultural engineers)
2. Science fields graduates, 1955: 59,000 graduates (first-level degrees in all scientific fields including agriculture, representing about 20 percent of total first-level degrees) of which— 22,600 graduates were in engineering (first-level degrees)	2. Science fields graduates, 1955: 126,000 graduates in all scientific fields (including agriculture), representing 49 percent of total graduates— 61,000 engineering 20,000 agriculture 25,000 science teachers 10,000 university graduates in science 10,000 other science of which— 59,000 graduates were in engineering (57,000 engineers by rigid criteria—2,000 agricultural engineers)
3. Persons with advanced degrees, 1955: 114,600 living doctors of philosophy in all fields of which— 61,800 living doctors of philosophy were in science and engineering—natural science, biological science, psychology, mathematics, agriculture	3. Persons with advanced degrees, 1955: 80,000 to 85,000 living "candidates" (roughly equivalent to our doctor of philosophy degree in all fields 9,000 to 9,500 advanced doctor's degrees in all fields 89,000 to 94,500 total of which— 60,000 to 68,000 "candidates" in science 6,000 to 6,700 advanced doctor's degree in science 66,000 to 74,700 total

Comparison between United States and U. S. S. R. scientific personnel—Con.

United States	U. S. S. R.
4. Teachers, 1955:	4. Teachers, 1955:
1,360,000 teachers at all levels	1,900,000 teachers at all levels
181,000 teachers in higher educational establishments	120,000 teachers in higher educational establishments
1,164,000 teachers in elementary and secondary schools	1,600,000 teachers in regular primary and secondary schools
747,000 in elementary schools and kindergarten	(1,733,000 teachers in all primary and secondary schools)
417,000 in secondary schools (plus 15,000 teachers in other elementary and secondary schools for special purposes)	700,000 in primary schools (grades 1 to 4 of the 10-year school)
	900,000 in secondary schools (grades 5 to 10) (in addition about 180,000 teachers were in semiprofessional schools or tekhnikums and trade schools)
130,000 to 140,000 science and mathematics teachers in high school, 1955	350,000 science teachers in secondary schools (includes 70,000 to 100,000 teachers of mathematics)
5. Student enrollment, 1955–56:	5. Student enrollment, 1955:
2,721,000 total enrollment in institutions of higher education	1,865,000 total enrollment at higher educational establishments
6. Number of first-level degrees conferred in 1954–55, all fields:	6. Number of graduates from higher educational institutions (equivalent to our first-level degrees):
287,000	265,000

It can be seen from the table that the fields covered in the estimates of the number of living graduates in all scientific fields (with first-level degrees) and in the number of graduates in 1955 are not strictly comparable. The United States data cover the fields of natural science, psychology, agriculture and engineering. The Soviet data include engineering, agriculture, science teachers, and university graduates in science. Psychology was included in the United States data but excluded in the Soviet data, because although there are substantial numbers of psychologists here, in the Soviet Union there are very few. Secondary school science teachers with higher education were included in the Soviet data because they are trained as such. (Not all of the science teachers in the Soviet elementary and secondary schools have higher education.) The Foundation discovered that it was not feasible to collect similar statistics on United States science-teacher training, because elementary and secondary schoolteachers frequently receive degrees in the field of education, and college and university teachers receive degrees in a field of science.

In the United States, graduates in science may not necessarily be employed within the field in which they received their education, but in the Soviet Union they are likely to be. Our own supply should therefore be viewed as a potentiality, and the Soviet Union as more nearly an actuality. Of the total number of individuals holding advanced degrees in the two countries, a considerably higher proportion are in science and engineering in the Soviet Union than in the United States.

In making these comparisons, as well as comparisons of the number of teachers and of student enrollment, it should be noted that the educational system in the two countries are not comparable and that

there is a much greater diversity among fields of educational attainment in this country. Here the stress is on general education, specialization being reserved for higher levels of education, with only a limited amount of specialization at the secondary-school level. In the U. S. S. R., the reverse is the case, and even at the secondary-school level great stress is placed on specialized technical education. There is also a great difference in the structure of the educational systems.

In the Soviet Union, primary and secondary education is given in 10-year schools. Semiprofessional education is given in "tekhnikums," which are purely specialized schools. Universities and institutes comprise most of the higher educational establishments, and even these are highly specialized as compared with our own higher educational institutions. While the trend over the past few decades in the Soviet Union has been toward more technical education in order to satisfy the demands of industrialization, the United States has recognized the desirability of infusing technical education with a broader social and humanistic outlook.[2]

D. NEED FOR ENGINEERS AND SCIENTISTS

In 1956 the B. F. Goodrich Co. made a survey of the national need for engineers and scientists, with projections to 1967. Some of the findings reported from the survey were:

Unless we persuade more college freshmen to major in science and engineering, we will still be 100,000 short of our needs for scientists and engineers by 1967. After that the deficit will gradually diminish from effects of the increased postwar birthrate.

Assuming the supply and demand are now in balance, we can prevent a shortage by boosting the rate of science graduates from the present 186 per 1,000 students earning first degrees to a new rate of 205–215 per 1,000 for the next 10 years.

Another solution to the immediate shortage would be getting a larger number of high-school graduates into college.

In 1950 we were producing new scientists and engineers at the rate of 250 per 1,000 college graduates. By 1955 the rate had dropped to 186.[3]

Indicating the increased demands of our technological society, the number of scientists and engineers per 10,000 persons employed grew from 57 in 1930 to 148 in 1956. In the same period the ratio of scientists and engineers to the total population grew from 21 to 57.[4]

E. DEMAND FOR ENGINEERING GRADUATES

A recent survey by the Engineers Joint Council provides information indicating trends in the employment of engineering graduates. The survey, reported in October 1956, was carried out with staff assistance from the Engineering Manpower Commission.

The following conclusions, extracted in substances from the report, are based upon questionnaire replies from 414 industrial and govern-

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[2] National Science Foundation. (Press release 157, August 3, 1956.)

[3] According to information obtained from the Scientific Manpower Commission in the academic year 1955–56 there were 212 per 1,000 students earning first degrees in science and engineering.

[4] The Shortage of Engineers and Scientists. How It Will Grow Until 1968. (Steel, Dec. 10, 1956, p. 101.)

mental organizations employing in January 1, 1956, a total of 140,440 engineering graduates, or about 25 percent of the estimated total number of engineering graduates then in the United States.

The organization reported having need for net accessions (total of all new hires minus losses) numbering 20,125 by December 31, 1956, or a need for total employment of 160,571 engineering graduates by that date. However, these organizations were expecting their net accessions to number only 14,162, bringing their total employment of graduate engineers on December 31, 1956, to 154,608.

Comparison of these figures with similar data reported for previous years indicates a rise in demand for engineering graduates in 1956 substantially greater than in any other year since 1951. However, the data gave little indication that engineering demand is accumulative over the year. It is obvious that organizations have learned to perform satisfactorily with undercomplements of engineering personnel. Nevertheless, the data seem to warrant the assertion that graduation of between 35,000 and 40,000 engineers in 1956 would have considerably eased the situation.

The situation revealed by the survey does not have implications for the intermediate future. It is expected that for the next 3 years the engineering graduating classes will average about 35,000 a year. Such increase in the size of graduating classes, together with a somewhat reduced technological momentum, may ease the shortage. On the other hand, rapid growth in technological activity would leave little hope for numerical relief.

The survey showed the demands for technicians to be roughly comparable to the demand for engineering graduates. It yielded evidence of company efforts to relieve the shortage of engineering knowledge by better utilization of the talents of both technicians and engineers.[5]

F. EMPLOYMENT OF SCIENTISTS

In November 1956 the National Science Foundation reported in detail the "employment profile" of more than 94,000 scientists listed in the National Register of Scientific and Technical Personnel, 1954–55. In substance, the data showed that more than 92 percent of the scientists were employed, 3 percent were on active military duty, and the remaining 5 percent were full-time graduate students, retired, or for other reasons not employed.

The numbers of scientists in the register, number employed, and percent employed, by fields, 1954–55, were as follows:

	Number in register	Number employed	Percent employed
All fields	94,321	86,729	91.9
Astronomers	433	350	80.8
Biologists	16,303	15,159	93.0
Chemical engineers	6,710	6,570	97.9
Chemists	26,982	25,883	95.9
Geologists	11,831	11,132	94.1
Mathematicians	5,445	5,153	94.6
Meteorologists	3,211	1,932	60.2
Physicists	11,244	9,815	87.3
Psychologists	12,162	10,735	88.3

[5] Demand for Engineering Graduates in 1956. (Electrical Engineering, October 1956, pp. 886–889.)

Of a total of 85,146 employed scientists (in all fields) who reported their ages, the median age was 38 years.

About half of the employed scientists in the register held jobs in industry. Industry employed nearly 90 percent of the chemical engineers, about 70 percent of the chemists and geologists, nearly 45 percent of the physicists and 34 percent of the mathematicians.

Salary information was obtained for about 47,000 employed scientists in the 1954–55 register. The annual professional salary of half of these was more than $6,525. Half of the physicists were receiving more than $7,275 annually.[6]

G. TRENDS IN EMPLOYMENT AND TRAINING

A statistical study of trends in the employment and training of scientists and engineers was published by the National Science Foundation in May 1956. Major topics considered and findings with respect to them included:

1. Growth of science and technology

Workers in science and technology are a relatively small but rapidly growing segment of the labor force. In 1870 the ratio of workers in the labor force per worker in science and technology was over 1,000 to 1. In 1950 the ratio was only about 113 to 1.

2. Employment and training data

Private industry employs nearly two-thirds of our estimated 250,000 natural scientists and about three-fourths of our estimated 700,000 engineers.

About 10 percent of our young people graduate from college. More than half of those of higher intelligence (top one-fifth of their age group) do not enter college. The unrealized potential in this high-ability noncollege group is a challenge to any program aimed at increasing the numbers and improving the quality of the Nation's scientific and technical personnel.

Due to population growth and a higher rate of college enrollments, there has been a continuous rise in college graduations during the past half century.

About 25 percent of the men and 6 percent of the women who graduated from college in 1955 majored in science or engineering. Since 1900 the proportion of college graduates trained in natural science has tended to decrease and engineering to increase. Our college graduates come from public and private institutions in about equal numbers.

3. Future educational trends

College enrollments in future years will grow with the increase in the population of college age. If present trends continue there may be as many as 5 to 7 million students in the Nation's colleges and universities by 1970.

Increased enrollments will result in increased graduations in science and engineering. At presently projected rates of graduation there will be between 71,000 and 87,000 science and engineering graduates by 1960 and between 103,000 and 113,000 by 1965.

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[6] Rings, E. Eleanor. Employment Profile of Scientists in the National Register of Scientific and Technical Personnel, 1954–55. National Science Foundation, Scientific Manpower Bulletin, November 1956, 8 p.

4. Trends in the need for scientists and technicians

Needs for highly trained scientific and technical personnel may exceed even the anticipated increases in graduations. Future graduates in science and engineering will be required to help staff many expanding occupations and activities. Among these are: (1) high-school teaching, in which positions will nearly double by 1970; (2) college and university teaching, needing an increase from 196,000 positions in 1955 to 495,000 in 1970 to accommodate larger student enrollments; (3) research and development, for which expenditures are expected to grow from $5.5 billion in 1955 to $8.1 billion in 1970; (4) engineering jobs, expected to increase from 700,000 in 1955 to 1,550,000 in 1970.[7]

H. HIGH SCHOOL ENROLLMENTS IN SCIENCE AND MATHEMATICS

A basis for estimating our future supply of scientists and engineers lies in data on current enrollments in mathematics and science in the Nation's secondary schools. High-school students now concentrating on mathematics and science constitute the reservoir from which future scientists and engineers will be drawn.

Some widely publicized statements concerning the paucity of study of mathematics and science in the Nation's schools have been refuted in an extensive, research report from the Office of Education, Department of Health, Education, and Welfare. In regard to these statements this 1956 publication said:

> This study reveals that some public statements on high-school science and mathematics enrollments are erroneous. For example, it has been said that 50 percent of the public high schools offer neither physics nor chemistry. The fact is, however, that in 1954 the actual percentage was only about 23. It has also been stated that only 1 out of 22 high-school students take physics, whereas actually the ratio is closer to 1 out of 5. The number of pupils in chemisty has not declined 30 percent during the past 60 years—it has increased more than twentyfold. Two-thirds of the high-school pupils take algebra, instead of one-fourth.[8]

The data basic to these conclusions were obtained from a 10-percent sample of randomly selected public high schools, distributed throughout the country, in the year 1954. The data do not imply that the number of students pursuing mathematics and science courses is adequate to meet the demand of our technological society for specialized personnel.

Based on the grade in which the course is usually offered, the percentages of enrollment in science and mathematics were found to be as follows:

(1) Enrollment in biology equaled 72.6 percent of the number of pupils in the 10th grade.
(2) Enrollment in chemistry equaled 31.9 percent of the number of pupils in the 11th grade.
(3) Enrollment in physics equaled 23.5 percent of the number of pupils in the 12th grade.
(4) Enrollment in general mathematics equaled 44.5 percent of the number of pupils in the 9th grade.

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[7] National Science Foundation. Trends in the Employment and Training of Scientists and Engineers. Washington, Government Printing Office, 1956, 23 p.

[8] Brown, Kenneth E. Offerings and Enrollments in Science and Mathematics on Public High Schools. Office of Education, Department of Health, Education, and Welfare, pamphlet No. 118, 1956, 24 pages.

(5) Enrollment in elementary algebra equaled 64.5 percent of the number of pupils in the 9th grade.
(6) Enrollment in plane geometry equaled 37.4 percent of the number of pupils in the 10th grade.
(7) Enrollment in intermediate algebra equaled 28.5 percent of the number of pupils in the 11th grade.
(8) Enrollment in trigonometry and in solid geometry equaled approximately 13 percent of the number of pupils in the 12th grade.

Some other findings from the study were—

(1) Of those schools with 10th grade pupils, 89 percent offered biology.
(2) Those schools without biology were small ones enrolling only 3.3 percent of all 10th grade pupils.
(3) Approximately half of the schools offered physics and approximately half offered chemistry. The schools with neither physics nor chemistry were small ones enrolling only 5.8 percent of all 12th grade pupils.
(4) General mathematics was offered by 70.8 percent of the schools, elementary algebra by 89.8 percent, and plane geometry by 78 percent.
(5) Only about half of the schools offered solid geometry and trigonometry.

Unequal educational opportunities and unequal teacher loads were shown by the data on offerings, enrollments and class size.

I. CAREER CHOICE BY TOP STUDENTS

Information concerning choice of career by top high school graduates was obtained from a survey completed by the National Association of Secondary School Principals in 1956. The information was gathered from more than 12,000 young people who ranked scholastically in the top 5 percent of their high school graduating classes.

In connection with an annual scholarship competition administered by the National Association of Secondary School Principals, competing members of the National Honor Society (sponsored by that association) discussed their career plans. The contestants were all seniors standing in the highest 5 percent of their respective classes in 1956. These young people replied to questions as to what major courses they expected to pursue in college and what careers they had chosen.

Tabulation of the results showed teaching to be the choice of the greatest number, with engineering, science research, and medicine following in the order named. The career choices, by number and by percentage of the total of 12,154 students, were as follows:

Career choice	Number	Percent of total	Career choice	Number	Percent of total
Teaching	3,654	30.0	Government	252	2.1
Engineering	2,029	16.7	Creative arts	238	2.0
Science research	1,304	10.7	Ministry	222	1.8
Medicine	1,137	9.4	Home economics	192	1.6
Business	850	7.0	Social work	183	1.5
Undecided	777	6.4	Miscellaneous	118	1.0
Nursing	479	3.9	Agriculture	96	.8
Communications	299	2.5	Dentistry	59	.5
Law	265	2.2			

Of the 3,654 students who expressed the choice of teaching as a career, only 455 are boys. These figures do not support great hope for reduction of the teacher shortage, since many of the girls will give up their professional careers for matrimony.

Of the 2,029 students who said that they had chosen engineering only 59 are girls.

The reporters of the survey stated that lack of money annually prevents about 200,000 competent young people from going to college, and that a great increase in the number of scholarships would increase our supply of trained personnel about 50 percent.

J. COLLEGE ENROLLMENTS AND DEGREES

In a 1956 publication giving data on college enrollments and degrees the Director of the Research and Statistical Services Branch of the United States Office of Education said in part:

> With a well-recognized and serious shortage of teachers and engineers, special interest attaches to the enrollment in teachers' colleges and technological schools. * * * In general, the rise of enrollment in technological schools in the last 4 years has not been more rapid than the rise of enrollment in general. * * * Among teachers' colleges the differential has been more favorable, though still not strong. * * * Granted that the situation is not simple, that universities as well as separately organized professional schools train teachers and engineers, and that liberal arts colleges are both a source of teachers and a "feeder" for technological schools, it is still difficult to resist the conclusion from the data that students are not being attracted to teaching and engineering in the numbers desirable. This is a problem of grave national concern.[9]

Another 1956 statistical report from the United States Office of Education pointed out that—

> The current shortage of engineers appears to be part of a general shortage in the professional fields, caused in part by the low birth rates of the 1930's, in part by an expanding economy (creating a greater demand for professional services), and in part by the interruption of college careers by war and military service. An additional factor, in the case of engineering, is the increasingly technological nature of our economy. Rising college enrollments in certain fields, however, give promise of some improvement in the manpower situation. Thus, the annual increase in engineering enrollment from 1951 to 1955 have been 6.6, 9.5, 10.9, and 13.4 percent, respectively. These are large increases, even if not large enough to provide a prompt solution to the problem of the engineer shortage.[10]

The following projections of enrollments and degrees were released by the Office of Education in 1956:

Projections of regular session enrollment in institutions of higher education in continental United States: 1955–56 to 1970–71

Academic year	Regular session enrollment	Academic year	Regular session enrollment	Academic year	Regular session enrollment
1955–56	2,996,000	1961–62	4,212,000	1967–68	5,926,000
1956–57	3,232,000	1962–63	4,451,000	1968–69	6,243,000
1957–58	3,450,000	1963–64	4,637,000	1969–70	6,443,000
1958–59	3,623,000	1964–65	4,860,000	1970–71	6,676,000
1959–60	3,778,000	1965–66	5,199,000		
1960–61	3,964,000	1966–67	5,564,000		

[9] U. S. Department of Health, Education, and Welfare, Office of Education. Circular No. 460, 1956, 46 pages.

[10] U. S. Department of Health, Education, and Welfare, Office of Education, Circular No. 468, 1956, 35 pages.

Projections of bachelor's and first professional degrees to be conferred in the continental United States, by major categories of curricula—1955–56 to 1965–66

Year	Total	Biological sciences	Engineering	Healing arts	Physical sciences	Social sciences	All other
1955–56	325,000	10,200	29,400	26,500	11,900	87,800	159,200
1956–57	347,000	10,900	34,500	28,500	12,700	94,400	166,000
1957–58	392,000	12,300	37,300	32,300	14,300	107,400	188,400
1958–59	421,000	13,200	41,500	34,900	15,400	116,200	199,800
1959–60	437,000	13,700	43,100	36,500	16,000	121,500	206,200
1960–61	450,000	14,000	44,400	37,800	16,500	126,000	211,300
1961–62	459,000	14,300	45,300	38,700	16,800	129,400	214,500
1962–63	478,000	14,800	47,100	40,500	17,500	135,800	222,300
1963–64	515,000	16,000	50,800	43,900	18,800	147,300	238,200
1964–65	567,000	17,600	55,900	48,500	20,700	163,300	261,000
1965–66	576,000	17,800	56,800	49,700	21,000	167,100	263,000

K. COLLEGE ENROLLMENT PLANS

In December 1956 the Association of American Colleges reported its findings from a survey of college enrollment plans for the next 15 years. The survey covered plans of 515 liberal arts colleges—69 percent of all liberal arts colleges in the United States.

These institutions gave estimates of the numbers of men and women they would be willing to accept as full-time students in 4-year undergradute courses in the liberal arts and sciences in the academic years 1960–61, 1965–66, and 1970–71. Estimates were requested on two hypotheses: (1) That the present endowment and capital equipment of the college would not be increased or would be increased only in a manner definitely foreseeable at the time of answering; (2) that the college's capital resources could be increased to any extent necessary to correspond with its educational policy.

Following is a summary of the data obtained for all institutions responding.[11]

Hypothesis (1)—Prospective enrollments with foreseeable capital resources (515 institutions)

Enrollment 1955–56	701,000
Enrollment 1960–61	839,400 (20 percent over 1955–56)
Enrollment 1965–66	939,950 (34 percent over 1955–56)
Enrollment 1970–71	1,020,300 (45 percent over 1955–56)

Hypothesis (2)—Prospective enrollments with unlimited capital resources (515 institutions)

Enrollment 1960–61	942,450 (34 percent over 1955–56)
Enrollment 1965–66	1,116,200 (59 percent over 1955–56)
Enrollment 1970–71	1,275,550 (82 percent over 1955–56)

Among other points of interest, the data showed that a 20-percent increase in enrollment is all that can be expected of 4-year liberal arts colleges in the next 5 years unless they obtain capital resources beyond what can now be foreseen. This evidence bcomes more significant when considered in relation to the fact that in a single academic year, 1954–55 to 1955–56, the enrollments in liberal arts colleges increased 10 percent. The report of the survey concluded that:

> This throws into sharp perspective the need for a speedy and substantial increase in financial support.

[11] Data were tabulated for various types of institutions, such as independent colleges and tax-supported colleges.

L. TEACHER SUPPLY AND DEMAND

The problem of getting enough good teachers and keping them is an important part of the long-range problem of technical and professional manpower development.

1. Elementary and high-school teachers

For a number of years an annual report on elementary and high-school teachers supply and demand has been prepared in the research division of the National Education Association in cooperation with the National Commission on Teacher Education and Professional Standards. Here are some of the facts and implications brought out in the 1956 report.[12]

Prospects for a total of 96,079 new teachers graduating in June 1956, marking a 9.9 increase over the June 1955 total, were revealed in the study. Even more encouraging were figures showing a corresponding increase in every one of the high school teaching fields.

However, the proof of the pudding will lie in the number of these graduates who will be induced to accept teaching positions in the face of other competition for their services. The study showed that only 71 percent of the prepared teachers who graduated in 1955 actually entered the profession. The figure ran as high as 81.6 percent for elementary school teachers and 69.4 percent for English teachers but as low as 46.6 percent for chemistry and 55 percent for biology teachers.

The report stated that schools would need 175,000 new teachers by September 1956. This estimate included those needed to meet increased enrollments, to relieve overcrowding and half-day schedules, to expand educational programs in neglected areas, to replace the most unprepared teachers then in service, and to fill the vacancies of 85,000 qualified teachers expected to leave the profession in 1956.

Many of the teachers who would leave, according to the report, would be—

> among the best and in the fields of greatest shortage. The sheer financial loss in the existing routine—recruiting, preparing, inducting into service, then quickly forfeiting the fruits of these costly efforts—is scarcely equaled anywhere in American occupational life. In truth, increased efforts to retain good teachers can strike a telling blow at the teacher shortage.

The report emphasized that—

> The overriding need—the fundamental issue—is to bring the whole teaching profession to a higher level of appeal to talented youth.

In November 1956, the National Education Association issued a report containing estimates of elementary and secondary school teacher shortages for the school year 1956–57. On the basis of data supplied by State and Territorial departments of education and education associations, the association reported—

(*a*) A national shortage of 180,000 qualified teachers.

(*b*) Approximately 80,000 teachers employed by school systems without full qualifications for standard certificates.

The problem of personnel turnover showed up as a major factor in the teacher shortage. On the basis of records from 42 States, the total annual turnover was estimated to be 114,000 teachers. Of these, ac-

[12] The 1956 Teacher Supply and Demand Report. Journal of Teacher Education, March 1956.

cording to the report, about 92,000 will drop out of teaching and need to be replaced. About half of the 80,000 emergency teachers will also need to be replaced, and employment of approximately 48,000 new teachers will be essential to reduction of oversized classes. This makes a total of 180,000—the NEA's estimate of the total need for additional teachers in 1956–57.

Perhaps the principal consideration in the teacher shortage is the salary schedule.

The average salary of elementary and high school teachers is increasing slowly. It is now $4,025 for elementary and $4,560 for high-school teachers. The average for classroom teachers is $4,420. However, close to 71,000 teachers are being paid less than $2,500.

The salaries vary markedly among the States. Seven States reported the salaries of more than 25 percent of their teachers were below $2,500. On the other hand, 20 States reported that more than 25 percent of their classroom teachers are receiving $4,500 or over per year.[13]

2. Teachers in degree-granting institutions

Data on teacher supply and demand in degree-granting institutions for the school year 1954–55 were reported by the research division of the National Education Association in December 1955. Some of the data and major conclusions expressed in that report are:

Little is known about the nature of the amount of the demand for teachers by the colleges and universities of the Nation. However, participation by a substantial percentage of the degree-granting institutions in this investigation suggests that data obtained from it are indicative of conditions in the Nation as a whole.

The number of institutions that reported shortage of qualified teachers observed during 1953–54 or 1954–55 in each general field of teaching are:

Number of institutions reporting—644.

General field of teaching

	Number		*Number*
Agriculture	14	Journalism	3
Biological sciences	35	Law	2
Business and commerce	102	Library science	16
Education	109	Mathematics	187
Engineering	97	Philosophy	3
English	33	Physical and health education	50
Fine Arts	39	Physical sciences	446
Foreign languages	21	Psychology	44
Health sciences	30	Religion	2
Home economics	86	Social sciences	64
Industrial and vocational arts	20	No shortage in any field	26

The data supported the widespread belief that the greatest shortage of qualified college teachers is in the physical sciences. A total of 446 of the reporting institutions emphasized this. Next in frequency of observed shortage was in mathematics, reported by 187 institutions. Then followed education, reported by 109 institutions, and business and commerce, reported by 102 institutions. Every teaching field was included and only 26 of the institutions indicated that no shortage had been observed within the past 2 years.

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[13] National Education Association, Research Division. Advance Estimates of Public Elementary and Secondary Schools for the School year 1956–57, November 1956, 23 pp.

More vexing, if possible, than the question, "How many teachers will we need?" are the questions: "What are the sources of supply?" and "How adequate are they likely to be, year by year, for the next decade?"

The number and percent of institutions in which an oversupply of qualified teachers was observed during 1953–54 or 1954–55, in each field of teaching, were:

Number of reporting institutions: 613.

General field of teaching

	Number		*Number*
Agriculture	1	Mathematics	1
Business and commerce	2	Philosophy	18
Biological sciences	6	Psychology	7
Education	43	Physical and health education	19
English	177	Physical sciences	4
Fine Arts	78	Religion	12
Foreign languages	75	Social sciences	279
Geography	2	Miscellaneous	1
Home economics	1	No oversupply in any field	219
Journalism	1		

The report drew attention to—

> the unfavorable position of almost all higher education institutions in their ability to compete in the open market for the services of the qualified persons most desired for classroom teaching.[14]

M. SALARIES OF COLLEGE TEACHERS

The introduction to an extensive, 1956 report on college teachers' salaries, prepared in the research division of the National Education Association says:

> The shortage of competent teachers can rightly be charged to a number of contributing causes, but one stands far above all others in importance—insufficient salaries. Employing officials—elementary school, secondary school, and college—lack the necessary funds to enter the free competitive market and obtain the services of superior teachers in the numbers needed by today's educational system. The extent of the unmet need varies from one subject to another and from one institution to another but the net result is that emergency provisions are in operation almost everywhere.[15]

The report gave data on salaries paid and salary practices in universities, colleges, and junior colleges for the academic year 1955–56. Some of the principal findings from the study were:

Of all teachers holding the rank of full professor, one-half received a salary of $7,076 or more while one-half received that figure or less. The median salary for associate professors was $5,731; for assistant professors was $4,921; and for teachers with the rank of instructor, $4,087. For teachers of all ranks combined the median salary was $5,243.

Median salaries in different types of institutions varied from $6,435 in municipal universities to $4,081 in small nonpublic colleges. Other median salaries were: State universities, $5,649; nonpublic universities, $5,585; land-grant colleges, $5,401; State colleges, $4,992; nonpublic colleges of over 1,000 enrollment, $4,756; nonpublic colleges of 500–999 enrollment, $4,411.

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[14] National Education Association, Research Division. (Research Bulletin, December 1955, 163 pp.)

[15] Salaries Paid and Salary Practices in Universities, Colleges, and Junior Colleges, 1955–56. (National Education Association, Research Bulletin, October 1956, 163 pp.)

These salaries were paid for the 9-month academic year. A considerable number of all teachers have an opportunity to teach in summer sessions of varying length, for additional compensation. These additional employment opportunities were reported more frequently in larger institutions, where the general salary schedule is above the average, than in small colleges, where the salaries are generally lower.

The median salary of deans of professional schools was $10,416. Median salaries of some other administrative officials, for a full year's service were: president, $11,314; vice president, $10,416; dean of men, $5,983; head librarian, $5,434; dean of women, $5,200.

The report admonishes that we must organize our efforts if we are to induce a sufficient number of bright young people to undertake the rigorous preparation required for these positions.

N. OTHER STUDIES

Digests of other studies related to the question of professional manpower development appear in a report entitled "Federal Aid to Students for Higher Education," which was prepared in the Legislative Reference Service of the Library of Congress by Charles A. Quattlebaum, and was printed in June 1956 for the use of the House Committee on Education and Labor: Following is a summary of some of the principal findings from several of the statistical studies identified and reviewed more fully in that report.[16]

America's resources of specialized talent (report of the Commission on Human Resources and Advanced Training, 1954).—The national shortage of scientists, engineers, teachers, doctors, nurses, and specialists in some other fields will continue for the next few years. The shortage will remain much longer if the Nation maintains a high level of economic activity. The United States is wasting a large percentage of its most valuable human resources. Although the total number of college graduates is increasing, fewer than half of the upper 25 percent and only 6 out of 10 of the top 5 percent of high-school graduates are obtaining the higher education needed for full development of their potential usefulness to society. The Nation is producing enough persons competent for higher education to meet the demands for specialization in all fields.

Experience in Federal aid to college students (historical study by Helen Brookshire, 1955).—During the depression of the 1930's the Federal Government gained extensive experience in administering a broad program of Federal aid to individual students. By financing a wide range of part-time student work projects, the National Youth Administration gave assistance to over 2,134,000 different students between 1935 and 1943.

Background for a national scholarship policy (book by Elmer D. West, 1956).—The nationwide shortage of highly educated manpower is critical in many fields. There are various estimates of the amount needed for scholarships, but it appears that the amount needed is at

[16] The facts brought out in these and other studies considered in the report are too numerous to be fully covered by this summary. For full identification of the studies and further details the reader is referred to the June 1956 report. At the time of this writing copies are available from the Committee on Education and Labor.

least three times as great as the amount available. Data suggest that awarding a sufficient number of scholarships would cause three-fourths instead of only one-half of the top 27 percent of high-school graduates to enter college. Although opinion is divided, those administering scholarship funds seem generally to favor including demonstrated need as a requirement for scholarship aid, along with token or honor grants without reference to need.

College student retention and withdrawal (study by Robert E. Iffert, 1956).—On the basis of information obtained from a nationwide sample of 13,669 students, it appears that the principal reason for dropout from college during the first year is academic problems. The principal reason for dropout after the first year is financial difficulties.

Costs of attending college (study by Ernest V. Hollis and associates, 1956).—According to recent information obtained from 15,306 college and university students constituting a national sampling, their average annual expenses amounted to $1,120 in publicly controlled institutions and $1,674 in privately controlled colleges and universities.

Crucial questions about higher education (studies carried out by staff members of the State University of New York with the collaboration of officials of the State education department, 1955).—In 1953 nearly 22,000 New York high-school graduates in the upper half of their classes failed to enter college. Of a sample of 4,414 of these students 43 percent desired to continue their education. Of a sample of 9,954 high-school graduates about 17 percent were expecting scholarships.

Encouraging scientific talent (report by Charles C. Cole, Jr., and associates, 1956).—(1) There are important losses to the future scientific labor force as a result of some poor teaching, insufficient guidance, and inadequate facilities in the Nation's overcrowded elementary and secondary schools; (2) many competent, well-trained, stimulating high-school science teachers are leaving the schools; (3) deterrents in our society and lack of motivation in some instances prevent superior high-school graduates from attending college; (4) insufficient financial resources appear to be the sole or primary reason why 60,000 to 100,000 of these persons of superior ability fail to enroll in colleges each year.

Soviet professional manpower—Its education, training, and supply (study by Nicholas DeWitt, 1955).—The Soviet Union is graduating almost twice as many specialists in certain (mainly scientific) fields as is the United States. Soviet training of specialists is accomplished by sacrificing other education that the democracies consider important.

What the GI bill did for America (study by Sam Stravinsky, 1955).—The GI bill turned out to be a wise national investment in the Nation's most important resource—people. Having freedom of choice of higher educational goals, about 774,000 veterans chose training to become scientists as against only 460,000 who chose the humanities and 100,000 who chose studies and preparation for activites in social welfare.

CHAPTER VII

DIGEST OF PUBLISHED OPINIONS

A. INTRODUCTION AND SUMMARY

A study of the recently published opinions of a number of individuals concerning our technical and professional manpower problem is very revealing. Examination of these views shows that data on the shortages can be given different interpretations.

This chapter brings together, digests, and summarizes selected individual assertions published in 1956 relating to a number of aspects of the manpower situation. The chapter does not cover all such published opinion. The material included herein was selected on the basis of its being of particular interest or being representative of a segment of opinion bearing on the problem. Many of the articles included in this digest also give factual information. However the emphasis here is upon interpretations of facts and impressions of their significance.

Persons concerned with the accuracy of statistics appearing in this chapter may be interested to compare them with data given in the preceding chapter—particularly in the reported study made in the United States Office of Education which contradicts some of the figures published earlier. Persons further interested are referred to an article entitled "Check That Statistic," by T. M. Stinnett, in the Educational Record for April 1957.[1]

Briefly, some of the principal ideas expressed in the material covered by this chapter, and the authors of these ideas (not exact quotations) are:[2]

***John W. Gardner, president of the Carnegie Corp.*—Technical innovations and social complexities have created talent demands running far deeper than the advertised shortage of the moment. We are spending 2¾ as much for alcoholic beverages as for our colleges and universities. Our future depends upon our sense of values shaping it.**

***Maynard M. Boring, president of the American Society for Engineering Education.*—Recent developments demand engineers with a much greater scientific and mathematical understanding. The teacher shortage is one of the most critical problems that we face as a nation. Our educational system is the foundation of our productive power.**

***Dael Wolfle, of the American Association for the Advancement of Science.*—Larger percentages of future generations will have to be educated for work in fields of high-level specialization. We**

[1] Pp. 83–90.
[2] In selecting ideas for inclusion here, special consideration was given to those having implications for legislation.

should encourage and foster the development of careers of research and scholarship.

Henry David, executive director, National Manpower Council.—The manpower problem in the United States is qualitative rather than quantitative. It is a problem of lifting the skill level of our society as whole.

Willard H. Libby, Commissioner, United States Atomic Energy Commission.—Trained manpower is the most important single factor limiting the peaceful application of atomic energy. The base of our training system needs strengthening by improvement of education in the secondary schools.

Eliot Tozer, researcher and writer.—The problem of engineering manpower is nationwide and urgent. As a people we must place a premium on scholarship. Both Government and industry must help to produce more scientists, engineers, and technicians.

Howard A. Meyerhoff, executive director, Scientific Manpower Commission.—Science has lost stature through concessions to vocationalism. The dearth of gifted teachers, already acute in secondary schools, will soon be felt in our colleges.

Monroe E. Spaght, executive vice president of Shell Oil Co.—National survival requires that we have more scientists and engineers. The blame for our educational shortcomings rests squarely upon the public, for its neglect of its teachers.

Charles C. Mason, superintendent of Tulsa public schools.—The demands for well trained personnel are increasing in all fields but especially in teaching, the mother of all professions. We cannot solve our problems by overemphasis on present need for training in certain subjects.

Rear Adm. H. G. Rickover.—Since we cannot match Russia's manpower in numbers, we must excel in quality. We must increase the percent of national income spent on education.

Lt. Gen. Emmett O. Donnell, Jr., United States Air Force.—We must provide counsel, motivation, and financial aid to students for higher education. We must add to the attraction and holding power of the teaching profession.

James R. Killian, president, Massachusetts Institute of Technology.—We should begin our attack on our professional manpower shortages with about 9,000 competitive, annually awarded Federal scholarships. Girls as well as boys should be encouraged to compete for them.

Brig. Gen. Stephen R. Hanmer, United States Army.—In this time of national emergency the Federal Government should not leave to the States an educational responsibility which perhaps they cannot and certainly they will not carry out in time.

Raymond F. Howes.—If scholarship awards are made on the basis of a nationwide competitive examination they will be concentrated in a few geographical areas.

B. THE GREAT HUNT FOR EDUCATED TALENT

In a very recent article the president of the Carnegie Corp. expressed his opinion on what the shortage of educated talent promises for the uncommon man, for the universities, and for business.[8]

[8] Gardner, John W. The Great Hunt for Educated Talent. (Harper's magazine, January 1957, pp. 48–53.)

DIGEST

One of the most historic changes marking our era has been the movement from waste of human talent to great effort to discover and develop it. The present talent hunt is an expression of a revolutionary change in society's attitude toward talent.

The rapid rate of our technical innovation and the social complexities that have come in its wake have created a talent demand running far deeper than the much advertised shortage of the moment. We need not only scientists and technologists but also gifted teachers and other professional men, scholars, critics, and seers.

While the demand for professionally trained scientists and engineers has multiplied, education has become the road to high positions in American business and industry and in general. Our colleges and universities have achieved remarkable prestige and are being given tasks of unprecedented range and importance.

The individual's role in our society has come to be determined not by *who he is* but by *what he can accomplish.*

Stung by grave shortage in a number of fields we have begun the search for gifted youngsters. The demand for educated talent will lead to more competition in our educational system. Our more alert educational institutions are recognizing that every specialist needs a substantial base of general education. Today's narrow specialization may not be needed tomorrow.

The modest percentage of our gross national income expended for education is at its lowest point since 1951. We spend 2¾ as much for alcoholic beverages as for the financing of our colleges and universities. The problem of financing is one of a number facing our institutions. The quality of our future leadership will depend upon the sense of values which guides our efforts toward its production.

C. THE MANPOWER SITUATION

Dr. Maynard M. Boring, while Chairman of the Enginering Manpower Commission of Engineers Joint Council and president of the American Society for Engineering Education, commented on the manpower situation in an article published in March 1956.[4]

DIGEST

Industry is aware of its need not only for more but also better-trained manpower. To insure our future national security and maintain our improved standard of living immediate steps must be taken to remedy our manpower deficiencies.

Advances in the use of atomic energy and other developments demand engineers with a much greater scientific and mathematical understanding.

The length of the typical 4-year engineering undergraduate training program has increased to 4.7 years because of attempts to make up deficiencies in high-school studies. The shortage of engineering graduates is stimulating the production and use of technicians.

[4] Boring, Maynard M. The Manpower Situation, 1956. (General Electric Review, March 1956, pp. 26–27.)

Many reasons, often of a financial nature, contribute to our high loss of talent. Only half of our qualified high-school graduates enter college, and only half of those who enter continue to graduation.

The teacher shortage is one of the most critical problems that we face as a Nation. We must solve the problems of inadequate salary and low social position of the teacher.

To reach its full productive power, industry must recognize that our educational system forms the foundation of it all. If we are to maintain our world leadership we must stress not only improvements of education in mathematics and science but also our social and cultural development.

D. EDUCATION AND NEW APPROACHES TO MANPOWER

This article by Dael Wolfle, of the American Association for the Advancement of Science, emphasizes the implications for education observed in population and industrial trends.[8]

DIGEST

Automation will gradually increase the demand for engineers and other workers with highly developed skills and will lessen the demand for less-skilled workers. A trend of this kind has been going on for decades, as shown by the fact that now about 1 industrial worker in 50 is an engineer whereas in 1900 only about 1 in 250 was an engineer.

The rapid increases in our population and productivity are having different net effects upon different occupations. For example because of the greater productivity of agricultural workers, we can get along with fewer of them. On the other hand, the increase in number of children and in educational requirements will create a demand for many more schoolteachers.

Population and industrial trends have developed shortages of (1) persons of highest competence in nearly all occupations, (2) persons whose primary interest lies in creative scholarship, (3) people who are competent to work in newly developed fields, (4) persons willing to work in situations where the rewards are less attractive.

The mobility of our labor force will facilitate the development of automation.

The trends here considered have seven implications for education, namely:

(1) Larger percentages of future generations will have to be educated for work in science, engineering, business management, and other fields of high-level specialization.

(2) Maintenance of present teacher-pupil ratios for the next decade will require over half of *all* college graduates to become teachers in elementary and high schools, and a doubling of the faculty for higher education.

(3) Schools will have an increased responsibility to give as good educational and vocational guidance as possible.

(4) Colleges and professional schools should consider their teaching in relation to the intellectual flexibility and occupational mobility of their graduates.

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[8] Wolfle, Dael. Education and New Approaches to Manpower. (Teachers College Record, February 1956, pp. 290–294.)

(5) Improvement of instruction in mathematics has become a problem for all educational levels.

(6) We should encourage and foster the development of traits and careers of research and scholarship.

(7) The simultaneous maintenance of freedom of individual career choice and optimum distribution of talent is a problem for our best educational and social statesmanship.

E. RESEARCH FINDINGS IN THE MANPOWER FIELD

This article by Henry David, executive director, National Manpower Council, deals with human resources development and manpower utilization.[6]

DIGEST

By manpower we mean not merely the working population but also human resources capable of development.

Because recently the supply of certain kinds of personnel has been inadequate to meet demands, there has been a continuing concern with our manpower resources.

Significant imbalances in the relationships between demand and supply constitute problems of study. A short supply of physicists to maintain a guided-missile program or lack of enough teachers and doctors for needed educational and health services may entail intolerable costs to society.

Investigations of imbalance in manpower demand and supply involves consideration of both the development of the supply of personnel and its effective utilization. Critical examination of the utilization of engineers and teachers may put a different face on the problem of shortages of them.

The supply can always be made adequate by changing the demand. If Government and industry should reduce their research and development activities, the demand for engineers and scientists would be greatly reduced.

Major findings from recent manpower studies are—

(1) There is a complexity of factors affecting the trained manpower supply and demand and slight changes in any one of the factors may have great consequences.

(2) Manpower development and utilization are influenced by an interplay of policies, emanating from various sources such as the home, schools, government, employers and trade unions.

(3) In the United States the manpower problem is qualitative rather than quantitative in nature. It is a problem of lifting the skill level of our society as a whole and of each group in the labor force. The Nation's interest in education is far from sufficient.

(4) The well-being and progress of our society depends heavily upon the quality of our manpower resources.

(5) Much of the Nation's human resources potential of high ability is not adequately identified and developed.

(6) Fairly high demands for highly trained manpower in all fields must be expected in the future.

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[6] David, Henry. Research Findings in the Manpower Field. Teachers College Record, November 1956, pp. 73–78.

F. EDUCATION AND THE PEACEFUL ATOM

An address on the above subject was delivered by Willard H. Libby, Commissioner, United States Atomic Energy Commission, before the Dean's Conference on Engineering Education and Nuclear Science at Oak Ridge, Tenn., on September 7, 1956.[7]

DIGEST

The role of educators has taken on new importance in our national life. Educators must not only teach young Americans the fundamentals of democracy but must also give our youth the technical training necessary for its survival.

The number of our graduating scientists and engineers has been declining. In 1954 the number was less than half that of 1950. In 1954 Great Britain graduated 57 engineers per million of population, the United States 136, and the U. S. S. R. 280 per million of population. (The U. S. S. R. is graduating an additional 326 lower grade engineers per million of population.) With a population approximately one-third greater than that of the United States, the U. S. S. R. is graduating more than twice as many engineers with similar extent of training.

The prizes in a technical race will not necessarily go to countries with the largest populations, but will go to those having the best educational systems. We need more scientists, engineers, and technicians with better and more versatile training. Trained manpower is the single most important limiting factor for the peaceful application of atomic energy.

Reasons for our trained manpower shortages include a low birthrate during the depression years, and the inadequacy of salaries to attract and keep the best-qualified teachers of science and mathematics in the high schools.

The large number of high-school graduates of exceptional ability who do not attend college represent America's most wasted human resources.

We must improve the teaching of science and mathematics in our high schools by providing more qualified teachers, and by other remedies. Salary increases would be the most effective incentive to the choice and continuation of teaching careers by highly qualified scientists and engineers.

The structure of our need can best be visualized as a pyramid. Its base needs strengthening by improvement of education in the secondary schools. The immediate problem in the development of atomic energy usage is the lack of trained faculty, facilities, and equipment at universities.

The Atomic Energy Commission is playing a part in relieving some of our educational shortcomings. It proposes to do more in the future, until the colleges and universities develop the capacity to assume more of the lead.

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[7] Libby, Willard H. Education and the Peaceful Atom. Department of State Bulletin, September 17, 1956, pp. 445–451.

G. WHAT THE ENGINEERING SHORTAGE MEANS

This article of fact and opinion concerning the significance of the engineering shortage, which appeared in Aviation Age for July 1956, was based upon extensive "planning and research." [8]

DIGEST

The engineering shortage is a threat to aviation progress and to America's way of life and world leadership. Unless we find ways of producing enough new, young scientists, engineers, and technicians, all the splendid achievements of American aviation will come to naught.

Today the aviation and electronics industry and the military services are competing for engineers. The problem of engineering manpower is nationwide and urgent.

The United States has 760,000 engineers and scientists; Russia has 890,000. Last year we graduated 70,000 while Russia graduated 120,000.

Our country—the most highly industrialized on earth—cannot survive without a solid foundation of technological scholarship and know-how. To maintain its relative position in the world economy, American industry must produce 10 years from now about 40 percent more than it produces today. As a people we have never placed a premium on scholarship, but that is what we badly need today and will need even more tomorrow.

Russia has been able to force her youth to dedicate itself to study, mostly in scientific subjects. Graduates from Soviet secondary schools have had 10 years of mathematics, 1 year of astronomy, 4 years of chemistry, 5 years of biology, and 5 years of physics. On the other hand, nearly half of the high schools in the United States offer no instruction at all in physics, chemistry or advanced mathematics.

All the experts agree that if we are to succeed in making the necessary basic changes to produce enough scientists, engineers and technicians, both Government and industry must help.

H. THE PLIGHT OF SCIENCE EDUCATION

In a recent article in the Bulletin of the Atomic Scientists, The Executive Director of the Scientific Manpower Commission discussed aspects of science education in relation to scientific manpower production.[9]

DIGEST

Science has lost much of its natural philosophic and scholastic character and has become increasingly vocational. It has lost stature through concessions to vocationalism.

Universities with large graduate schools commonly provide only mediocre and uninspired instruction at the undergraduate levels.

Forty percent or more of the vacancies for teaching mathematics in secondary schools are being filled by persons incompetent to teach

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[8] Toner, Eliot. What the Engineering Shortage Means. Aviation Age, July 1956, p. 20+.

[9] Meyerhoff, Howard A. The Plight of Science Education. Bulletin of the Atomic Scientists, November 1956, pp. 333–337.

it. Only one-fourth of the Nation's high school students are taking 2 years of algebra, and fewer than 10 percent acquire a mathematical foundation for college study of science and engineering. The pinch for gifted teachers soon will be felt in the college level.

Scientists' indifference toward brilliant teaching and their neglect of the teaching profession are suicidal acts contrary to the national interests. Partly as a consequence, there is little public appreciation of science and technology.

The remedy for these deficiencies and failure lies in education, but it cannot begin without communication. The lack of concern of specialized scientists with communication is already evident in the diminishng supply of teachers, whch will be followed by a shrinking pool of students.

Good teaching must be employed to inspire more students to enter the teaching profession, particularly at the secondary level. Self-preservation requires the restoration of learning, the resurrection of scholarship, the reentry of science into education.

I. AN OIL EXECUTIVE PONDERS THE ENGINEER SHORTAGE

The viewpoint of Monroe E. Spaght, executive vice president of Shell Oil Co., concerning the shortage of engineers and scientists was reported in the Oil and Gas Journal for January 16, 1956.[10]

DIGEST

The high schools of the United States are turning out fewer and fewer graduates aiming at the engineering and scientific professions. Industry is not as alarmed as it should be over this. The shortage will get worse before it gets better. National survival requires that we have more scientists and engineers.

Since 1900 the percentage of high-school students studying algebra has fallen from 36 to 24 percent. The percentage studying geometry has dropped from 27 to only 11 percent, the percentage studying physics has decreased from 19 to 4.3 percent.

The blame for this rests squarely on the public—for its neglect of its teachers. The supply of qualified teachers available each year is below the demand, nevertheless many who are trained to teach take up other occupations immediately or soon after graduation. A study showed that only 43 percent of 1953 graduates qualified to teach science and mathematics were actually doing so a year later.

As we have let our teachers down financially so we have let the prestige and hence the appeal of teaching fall in this country.

The Shell Companies Foundation, Inc., is operating a program to help bolster the country's educational system. The program began with fellowship for graduate work in physical science and engineering. Later the Foundation began making grants to outstanding departments of universities for pure research. To these provisions have been added the underwriting of summer seminars for selected high school teachers.

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[10] An Oil Executive Ponders the Shortage of Engineers. Oil and Gas Journal, January 1956, pp. 64–66.

J. A SCHOOL OFFICIAL LOOKS AT THE ENGINEER SHORTAGE

In an article in the Oil and Gas Journal for February 6, 1956, Dr. Charles C. Mason, superintendent of Tulsa public schools, expressed his views concerning the shortage of engineers, scientists and mathematicians.[11]

DIGEST

There are shortages of trained manpower in science and engineering but shortages are not peculiar to the fields. The demands for educated personnel are increasing in all areas—in medicine, business, and especially in teaching, the mother of all professions.

As late as the winter of 1949–50 the United States Bureau of Labor Statistics predicted an approaching oversupply of engineers. Colleges and schools advised students against entering a profession expected to be overcrowded. Then the Korean incident, advances in the use of nuclear energy, and the application of electronics to automation, created an unprecedented demand for engineers. The recent sudden discovery by industry that a shortage exists shows industry did not foresee the turn of events.

Industry is getting nearly all of the students being trained in science by the colleges. In addition, industry is luring science teachers away from the public schools by offering salaries the schools cannot pay. Because of the greater financial inducements many young people are preparing for industrial careers in science, but very few for careers in the teaching of science.

Some fallacious approaches to this problem have been taken. Because of the tremendous population of the Soviet orbit we cannot hope to compete numerically with Russia in production of scientists. Neither can we solve our problem by overemphasis on present needs for training in certain subjects. Other equally important subjects may slip into neglect.

Schools are responding to the present demand and a larger percentage of college freshmen are enrolling for engineering courses. However many high-school graduates of fine potential are failing to enter college for lack of motivation or lack of money. An improvement program would include: (1) Provision by industry for scholarships for prospective teachers of science and mathematics; (2) aid from industry to public schools comparable to what industry is now giving to private institutions; (3) increase in the percentage of national income spent for schools (only 2.8 percent in 1953–54 as against 3.2 percent in the depression year 1933–34); and (4) provision of better salaries and greater incentives for teachers.

K. AMERICAN ENGINEERING AND SCIENCE EDUCATION

In an article in the May 26, 1956, number of School and Society, Rear Adm. H. G. Rickover discussed the situation in American engineering and scientific education.[12]

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[11] Mason, Charles C. A School Official Looks at the Shortage of Engineers. Oil and Gas Journal, February 6, 1956, pp. 58–59.

[12] Rickover, H. G. The Situation in American Engineering and Scientific Education. School and Society, May 26, 1956, p. 175–179.

DIGEST

In the race for survival a nation progresses or falls back to the degree that it provides or fails to afford each individual citizen maximum educational opportunity.

In 1954 Soviet Russia graduated more than 50,000 engineers and scientists; the United States 23,000. By 1960 it is estimated Russia will have more engineers and scientists than we. Russian engineers are technically as well trained as ours, but at a sacrifice of general education.

Without an acceleration of our rate of production of scientists and engineers our economy will soon be in serious trouble for lack of technological nourishment.

As an expression of what the Soviet peace offensive means to the Russians, recently Khrushchev said:

> We don't have to fight. Let us have peaceful competition and we will show you where the truth lies. * * * Victory is ours.

Since we cannot match Russia's manpower in numbers we must excel in quality. All of our qualified youth should obtain a college education. At present 60 percent of the best students graduating from high school do not go on to college, and nearly half of those who enter college do not graduate.

We must increase the percentage of national income spent on education, and lengthen the schoolday. A partial solution to the high-school problem would be to establish two kinds of schools, one with higher standards than the other. If it is democratic to give special care to our retarded children it is democratic to make special provisions for our brightest children.

At their own expense, industrial organizations should make available their scientists and engineers for 1-day periods of teaching in our schools and colleges. Industry can also help by providing scholarships and financial contributions to education. Contributions by labor unions also would help.

The way we meet the task of helping every youth to his highest intellectual growth will determine the future of our country.

L. IMPACT OF SCIENTIST AND ENGINEER SHORTAGE

In an article in Signal for May–June 1956, Lt. Gen. Emmett O'Donnell, Jr., USAF, expressed his views concerning the shortage of scientists and engineers with special references to its effects upon United States Air Force requirements.[13]

DIGEST

We are losing a war because we are not producing more and better scientists and engineers than the Communists. At present rates of annual graduation, the Soviet Union will have a greater number of graduate engineers than the United States within the next 5 years. Most of the new Soviet engineers are graduates of 6 years of intensive training as against the usual 4-year program in the United States. It would be a tragic error to underestimate the abilities of the Soviets.

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[13] O'Donnell, Emmett. The Shortage of Scientists and Engineers and Its Impact on Our Air Technical Programs. Signal, May–June 1956, pp. 31–34, 71.

Nevertheless, with our long-held headstart in technical knowledge, we may be able to recapture the ground we have lost and add to it. There appears to be a rising trend in the number of our engineering graduates each year, but a shortage of over 60,000 is expected by 1960. By that year the shortage of physical scientists may exceed 50,000.

Our expanding economy now requires about 35,000 new engineers in addition to 20,000 replacements annually. Civilian and defense needs must be weighed in a delicate balance.

Every command in the Air Force has requirements for professional engineers and scientists. Research and development, communications and electronics, armament engineering, and maintenance engineering all call for officers with an educational equivalent at least that of a bachelor's degree. As of December 1955, however, the percentage of assigned officers in these fields with degrees ranged from 100 percent in research and development to 21 percent in maintenance engineering.

Half of the upper 20 percent of high school graduates do not enter college. Thus each year we lose 120,000 to 130,00 potential professional men. To reduce this loss we can give our high school students proper counsel and motivation and also financial assistance for higher education. The percentage of total student fees paid by scholarships and fellowships actually decreased from 7 percent in 1949 to 5 percent in 1955.

Increasing the number of high school students studying mathematics and science will aggravate the existing shortage of teachers of these subjects. We must therefore add to the attraction and holding power of the teaching profession. Industry and Government can accomplish this by providing teachers with "fringe" benefits such as summer scholarships, and awards comparable to the gift of an automobile to a successful football coach.

However the basic problem is teachers' salaries. We can and must do our part to see that there is a narrowing of the gap between the national rewards in teaching and in industry.

M. A BOLD STRATEGY TO BEAT SHORTAGE

In an article bearing the above title, the president of Massachusetts Institute of Technology has discussed the scarcity of scientists and engineers and related considerations, and offered a four-point plan to reduce the shortage.[14]

DIGEST

To reduce our well-advertised shortages of scientists and engineers we must use incentives instead of directives. We need a bold national program of tactics and strategy to solve the problem.

Things we must not do are: (1) allow the pressure for scientists and engineers to obscure the need for trained personnel in other fields, (2) engage in an academic numbers race with the Soviets, and (3) lower standards of training in order to increase the numbers trained.

Of the top third of our high school graduates (about 300,000 annually) about one-third obtain college degrees, another third apparently do not want to go to college, and the remaining third are financially unable to go. The Nation cannot afford to let any of these be without motivation or means to go.

[14] Killian, James R. A Bold Strategy To Meet the Shortage. Life, May 7, 1956, pp. 147–150.

We should begin our attack upon the problem with about 9,000 competitive, annually awarded Federal, scholarships, including: 3,000 for high school students of high ability wishing to study science and engineering; 3,000 for able students given freedom of choice of field of study; and 3,000 for high school students having already mastered such college freshmen subjects as calculus, physics, and English. Girls should be encouraged to compete for the scholarships in each category.

Such a Federal program should be a pump-priming booster effort launched in the hope that adequate private funds will be available to meet the need after 5 years.

Another attack on the problem might be made by a group of the best physicists in the country, who would plan a whole new approach to elementary physics education. A third needed action is a national forum like the recent White House Conference in Education to highlight ways of educating more and better scientists and engineers.

Fourth, we should outline a grand strategy for maintaining our technological advances. The plan should deal not only with manpower and its education, but also the utilization of manpower and personnel policies.

The need for foot soldiers of technology may lessen in the future but the need for flag officers will always be high.

The real problem of institutional training is finding enough great teachers, and expanding without damaging the quality of education and research. It is the glory of American education that the necessary decision can be made freely, institution by institution, and that out of the diversity of views can come a concensus, wiser because unregimented.

N. FEDERAL AID NEEDED AND FEASIBLE NOW

As one part of a 1956 study of Federal Aid to Education in the Light of Educational Crisis Affecting National Security, Col. (now Brig. Gen.) Stephen R. Hanmer, United States Army, gave his reasons for conviction that Federal aid is needed and feasible now—to whatever extent required to meet the educational crisis.[15]

Immediate action is needed to prevent our losing to Russia the race for technological superiority. Winning the race will provide our principal protection against Russia's masses and the deadly, undeviating purpose of its rulers to establish a Communist world under Russian domination.

In this time of national emergency the Federal Government should not leave to the States an educational responsibility which perhaps they cannot and certainly they will not carry out in time.

For years opponents of Federal aid to education have raised the bugaboo of Federal control of it. Avoidance of Federal control can be assured by simple provisions in the law.

History and commonsense tell us that Federal control will not accompany Federal aid to education unless the people want it that way, and there is abounding evidence that the people do not want it.

The trend in the history of education has been toward increasing public support at even higher levels of government—with, at first, public outcry against and, later, public approval of every stage of its

[15] Hanmer, Stephen R. Federal Aid to Education in the Light of Educational Crisis Affecting National Security. Industrial College of the Armed Forces, 1956, pp. 73–90.

evolution. This indicates that eventual major Federal support of education is inevitable. In this time of emergency we should act without waiting for the slow evolution.

As reported by Life magazine and as evidenced by various studies, a majority of our people are in favor of Federal aid to public schools. Members of Congress and other leaders failing to push for it are underestimating the temper of the people.

It is hard to understand the anomaly of $12 billion being paid out for economic aid and technical assistance to our allies and failure to provide any comparable Federal alleviation of the educational crisis here in the United States. Without a well-educated citizenry able to do the job that must be done in this atomic age we will lose everything.

We can afford the cost of adequate education for all our people. The White House Conference Committee reported that the Nation as a whole will have the fiscal capacity to finance both an increase in quality and quantity of education. The problem is making available for our educational needs a relatively small percentage of our national income with necessary action at local, State, and Federal levels.

O. FINANCIAL AID AND THE NATIONAL WELFARE

This article by Raymond F. Howes is 1 of 4 dealing with scholarships contained in the College Board Review for the spring of 1956.

DIGEST

The demonstrable demand for college graduates in many areas has for several years exceeded the supply; and the situation will grow worse unless drastic action is taken to relieve it. There seems to be a general recognition that the way to combat the professional manpower shortages is to induce a higher proportion of competent young people to graduate from college.

Estimates of the annual number of qualified high-school graduates who, because of inadequate finances do not enter college vary from 100,000 to 150,000.

Some of the States, notably New York and California, have taken action on the problem. The General Motors scholarship program and the national merit scholarship program are examples of recent, dramatic action by corporations. However, it has not been determined that these programs will make a substantial contribution to the solution of the basic problem—bringing into college students who otherwise would have been unable to attend.

Many of the privately supported national scholarship programs have the effect of augmenting the scholarship resources of institutions of high reputation which already control the bulk of institutional scholarship funds.

Significant developments in the Federal field include: (1) The approaching end of the enormous veterans' educational program, and (2) increasing awareness in the administration and in Congress of the serious national need for additional student aid. One measure before Congress would grant a 30-percent income-tax credit on amounts expended by the taxpayer for college tuition and fees for himself or someone else. Since this would not assist families in the lowest in-

come brackets, a supplementary scholarship program must be made available for them.

There is a problem of allocating student aid on a geographical basis, since, if scholarship awards are on the basis of a nationwide achievement test they will be concentrated in 1 or 2 regions.

PART IV. CURRENT PROGRAMS AND PROPOSALS

CHAPTER VIII

CURRENT FEDERAL AID TO STUDENTS FOR PROFESSIONAL TRAINING

(Particularly in the Sciences)

A. INTRODUCTION AND SUMMARY

Intelligent consideration of bills proposing Federal action to increase the production of scientists, engineers, and other highly trained personnel requires a general understanding of what the Federal Government is already doing in this field.

This chapter and the succeeding chapter deal with various aspects of current Federal participation in the development of professional manpower.

This chapter is concerned with Federal programs giving aid to students for the pursuit of professional training, particularly in the sciences.[1]

The programs discussed in this chapter, as a whole, provide aid of outstanding importance to professional manpower development. These programs are given special consideration in this report because of the emphasis contained in recent legislative proposals for further Federal promotion of such development. A majority of the recent proposals call for direct or indirect aid to individuals for the pursuit of higher education, particularly in the sciences and engineering.

The existing Federal programs providing such assistance have a number of limitations. The most important of these activities, from the viewpoint of cost and number of students aided—namely, the veterans' educational benefits program—is temporary and subsiding. Educational benefits under the GI bill generally terminated July 25, 1956. It is expected that the number of Korean-conflict beneficiaries will decrease steadily after this year. The influence of this program upon professional manpower development will decline proportionately.

The existing programs principally provide veteran- and military-education opportunities. Excepting veterans' benefits, they emphasize training in the sciences and in engineering, particularly at the graduate level. None of the existing programs has

[1] Principal sources: (1) Quattlebaum, Charles A., Federal Aid to Students for Higher Education. (84th Cong., 2d sess. House of Representatives, Committee on Education and Labor, committee print. June 1956. 191 pp.) (2) National Science Foundation, Federal Support for Science Students in Higher Education, 1954. (Washington, Government Printing Office, 1956. 33 pp.) (3) Information obtained from the agencies administering some of the described programs, November 1956.

for its basic aim the removal or reduction of financial barriers to the higher education of the Nation's most gifted and/or most needy young people.

Some of the programs which contribute to professional manpower development by providing aid to individuals for the pursuit of higher education are the following:

1. **Vocational training for disabled veterans and education and training for nondisabled veterans (largely at the higher-education level).**
2. **Fellowship awards by the National Science Foundation.**
3. **Financing of fellowships by the Atomic Energy Commission.**
4. **The Army, Navy, and Air Force ROTC programs.**
5. **Operation of the Military, Naval, and Air Force Academies.**
6. **Scholarships for United States citizens to study abroad under the international educational exchange program.**
7. **Fellowships and traineeships supported by the Public Health Service.**
8. **Operation of the United States Merchant Marine Academy and the Coast Guard Academy.**
9. **Provision by the Department of the Interior for the higher education of Indians.**
10. **Contractual arrangements between Federal agencies and educational institutions which result in employment of graduate students on research projects, thus providing indirect Federal aid to these students.**

In 1956 the National Science Foundation reported that the Federal Government gave financial support to nearly 390,000 students in higher education in 1954. Of these, nearly 362,000 or 93 percent were being aided under the veterans' educational program.

The percentages of the federally supported students who were studying sciences were approximately: Undergraduate students 24 percent, graduate students 48 percent, postdoctoral trainees 96 percent.

B. GENERAL CHARACTERISTICS OF FEDERAL PROGRAMS

The Federal Government is operating educational institutions of its own which provide free higher education, largely in the sciences and engineering, to selected individuals. Through the program of veterans' educational benefits and other programs, the Federal Government is giving aid to individuals for the pursuit of higher education, including training in science and engineering, at non-Federal institutions. However, the Federal contributions to the higher education of individuals is limited in a number of respects.

1. Limitations

The following limitations of existing Federal programs are of major importance in the consideration of current proposals for Federal aid to individuals for professional manpower training:

(*a*) Established Federal programs giving aid to students for higher education principally consist of veteran- and military-education opportunities. The programs other than veterans' benefits generally emphasize graduate training.

(*b*) None of the existing programs offers scholarships for which all high-school graduates are eligible to compete, with free choice of institution and course of study.

(*c*) Altogether, the existing programs will make available some Federal financial aid for the pursuit of higher education by only a small percentage of the Nation's high-school graduates this year.

(*d*) None of the existing programs has for its basic aim the removal of financial barriers to the higher education of the Nation's most gifted and/or most needy young people.

(*e*) None of the existing Federal programs operates on the principle of allocation of Federal funds to States for general scholarships to be awarded in accordance with prescribed terms.

(*f*) Some of the existing Federal programs do not provide benefits on the basis of State quotas.

(*g*) Existing programs provide financial aid to students for study only in certain fields or at certain educational levels, or else give such assistance only to a particular group of persons.

The first two limitations are illustrated in the program of the National Science Foundation, which presently awards fellowships only for graduate study in the mathematical, physical, medical, biological, engineering, and other sciences. The other type of limitation is illustrated by the veterans' educational program, which provides aid only to members of a particular group—namely, veterans. This constitutes a segment of a broader program of veterans' benefits.

2. Other features

In terms of number of students affected and cost to the Federal Government, the largest programs giving some direct aid to students in higher education are those administered by the Veterans' Administration, for veterans only, and by the Department of Defense, for the training of young men to become officers in the Army, Navy, and Air Force.

The veterans' educational benefits constitute by far the largest single Federal program directly aiding students in higher education. It gives assistance to members of this particular group of persons for study in practically all major subject fields. As has been pointed out in the preceding summary, it is, however, a temporary program. Educational benefits under the GI bill generally terminated July 25, 1956; the program for veterans of the Korean conflict continues, but it is expected that the number of beneficiaries will decrease steadily after this year.

The principal purpose of current Federal programs aiding students usually is not financial aid to students as such. For example, the main purpose of the Army Reserve Officers' Training Corps is to train Reserve officers for the Army. The fact that enlistment in the corps provides some financial aid to the general higher education of the individual enrollee is more or less incidental.

The Department of State is outstanding as an agency administering a scholarship program designed largely to implement an established policy of the United States Government. The Department administers the Fulbright Act and other acts which provide for educational exchanges with other nations for the promotion of international understanding and good will. The programs cover numerous

fields of study; however, about one-fourth of the American beneficiaries studying in foreign universities are pursuing courses in the natural and physical sciences.

Besides the National Science Foundation, the Department of Defense and the United States Public Health Service are outstanding among agencies carrying out programs to increase the supply of trained personnel in specific fields. The fields of emphasis are the physical, medical, and related sciences, and military science.

Investigation has revealed no comparable Federal program aimed at increasing the supply of trained personnel in the social sciences.

Opinions differ as to whether most of the existing Federal aids to students should be termed "scholarships." Some of the programs provide assistance only to graduate students and are ordinarily called fellowships.

Many persons take the viewpoint that some of the existing programs primarily represent compensation for services performed or contracted for, rather than direct financing of the education of students or provision of scholarships. Arguments for this attitude have been applied to veterans' education, the Reserve Officers' Training Corps, the research fellowships of the National Institutes of Health, and some other programs.

C. DESCRIPTION OF PROGRAMS, BY AGENCY

Following is a brief review of certain Federal programs which provide some aid to students for higher education, although in most cases this is not the principal or ultimate purpose of the activity. Whether these programs should be regarded as principally or partly or only incidentally student-aid programs is largely a matter of opinion.

The purpose of this summary of the programs is to provide a general concept of the Federal contribution to the professional education of individuals, without attempting to ascertain precisely and fully which programs should be included in this category or excluded from it.

Generally excluded from the description of programs are arrangements which ordinarily are regarded as in-service training of Federal agencies for their own personnel.

1. Veterans' Administration

The Veterans' Administration finances vocational rehabilitation training for disabled veterans and education and training for nondisabled veterans eligible to receive such benefits under acts of Congress. Generally the programs allow the individual veteran, under guidance, a choice of educational institution and course of study. A large percentage of the assistance given veterans is for the pursuit of higher education. In fiscal 1956 about 235,000 veterans received aid for education at this level.

It has been pointed out in the preceding summary of this chapter that the educational benefits for veterans of World War II which were provided by Public Law 346, 78th Congress, as amended, generally terminated on July 25, 1956. Such benefits for veterans of the Korean conflict are available under Public Law 550, 82d Congress. The termination date of this program was modified by Public Law 7, 84th Congress, to extend the basic service period in the case of a

person in active service in the Armed Forces on January 31, 1955, until the date of the person's first discharge or release from such service after January 31, 1955.

Public Law 16, 78th Congress, as amended, and Public Law 894, 81st Congress, as amended, provide for the training benefits for disabled veterans of World War II and the Korean conflict, respectively.

2. National Science Foundation

The National Science Foundation awards a limited number of fellowships for graduate predoctoral and postdoctoral training in the mathematical, physical, biological, engineering and other sciences.

The National Science Foundation Act provides that individuals selected for such awards are to be chosen solely on the basis of ability from among citizens of the United States. The act requires, however, the use of procedures which will result in a wide geographical distribution of the awards. The act further specifies that individuals chosen for these awards are to be given free choice of institution from among accredited, nonprofit American or nonprofit foreign institutions of higher education.

The numbers of fellowships awarded vary from year to year according to appropriations. The awards for the fiscal year 1956 numbered 895.

The Foundation also makes grants for the support of basic research in the mathematical, physical, biological, engineering and other sciences. In fiscal 1956 about 900 graduate students received stipends from the grantee institutions for services performed in connection with the Federal contracts.

3. Atomic Energy Commission

The Atomic Energy Commission supported fellowships in radiological physics, industrial hygiene, and industrial medicine numbering altogether 58 in fiscal 1956.

The Oak Ridge Institute of Nuclear Studies administers the fellowships in radiological physics. The fellowships in industrial hygiene are awarded to selected college graduates with degrees in basic science and engineering for graduate study in the Harvard University School of Public Health or the University of Pittsburgh Graduate School of Public Health. The Atomic Energy Project of the University of Rochester, Rochester, N. Y., administers for the Commission the fellowship program in industrial medicine.

The Atomic Energy Commission conducts an off-site research program through which graduate students are employed as research assistants in colleges and universities holding the research contracts. Institutions having such contracts with the Commission pay stipends from Federal funds to an estimated 2,000 graduate students annually.

The Commission supports two special graduate schools—the Oak Ridge School of Reactor Technology at the Oak Ridge National Laboratory and the International School of Nuclear Science and Engineering at the Argonne National Laboratory. The institutions trained 193 full-time students in fiscal 1956.

Full information concerning all activities in technical and professional education financed by the Atomic Energy Commission is not available from the Washington headquarters. At the time of this

writing a survey of such activities by the Commission's Division of Organization and Personnel is in progress.

4. Department of Defense

The departments of the Air Force, Army and Navy have Reserve Officer Training Corps programs, which enroll students. The following numbers of students enrolled in these programs in institutions of higher education received some Federal financial assistance during the fiscal year 1956: Air Force ROTC, 14,600; Army ROTC, 29,547; Naval "Regular" and "Contract" ROTC, 15,781.

The largest amount of aid per student was received by the "Regular" NROTC enrollees who received $50 per month retainer pay besides tuition, fees, books, instructional equipment, and uniforms. Under this program the Navy Department awards approximately 1,800 4-year scholarships annually to high school seniors. Such individuals are free to choose their programs of study. Upon graduation they are obligated to accept a commission in the Regular Navy or Marine Corps and spend 3 years on active duty.

In the fiscal year 1956 a total of 6,318 students was enrolled in this program. About half of these were enrolled in the sciences, including engineering.

The Air Force, Military and Naval Academies provide appointees to these institutions with free higher education leading to academic degrees. The appointees receive board and room and other benefits. Altogether, the training at these institutions is principally in the fields of science and engineering.

The average strength of the corps of cadets at the Military Academy was 2,255 in fiscal 1956. The total enrollment at the Naval Academy that year was 3,750. As of July 15, 1956, the enrollment at the Air Force Academy was 520.

The Department of Defense indirectly provides aid to graduate students through its research contracts awarded to colleges and universities. According to a rough estimate obtained from that Department in fiscal 1956 about 5,000 graduate students were employed by the institutions as research assistants on projects financed by these contracts. An estimated two-thirds of these research assistantships were in the physical sciences and engineering.

5. Department of State

Under the international educational exchange program 986 Americans received grants for graduate university study abroad and 1,984 foreign nations received grants to come to the United States for university study in fiscal 1956.

The general purpose of this program, as stated in Public Law 402, 80th Congress is: "to promote a better understanding of the United States in other countries and to increase mutual understanding between the people of the United States and the people of other countries."

As a whole, the program for foreign study by United States citizens contributes to the development of the professional manpower of this country. About one-fourth of the United States citizen grantees are pursuing courses in the natural and physical sciences.

6. Department of Health, Education, and Welfare

(*a*) *Public Health Service.*—In fiscal 1956 the National Institutes of Health (Department of Health, Education, and Welfare) alto-

gether awarded financial assistance to about 1,407 graduate students for study or research in the field of public health, generally for the purpose of increasing the number of physicians trained to combat particular diseases.

The Public Health service administers, directly or through educational institutions, fellowship and traineeship award programs to support individuals working toward their doctorate degrees in the basic health sciences, and also to support individuals preparing for public health services, nursing education or administration, psychiatric social work, service in clinical psychology, and for a number of specialized fields in medicine.

Public Health Service grants-in-aid to State and local health departments may be used by these departments to train their personnel.

The Bureau of State Services provides training courses for State and local health department personnel in highly specialized fields.

The Public Health Service has initiated two new types of training: the student part-time research fellowship and the senior research fellowship in preclinical sciences. The part-time fellowship is intended to give the student in medical, dental, nursing, and public-health schools an opportunity to determine early in his career whether he has a natural interest in research. The senior research fellowship is intended to strengthen research in preclinical departments by providing stipends for additional staff to teach and carry on research.

(*b*) *Office of Vocational Rehabilitation.*—The Office of Vocational Rehabilitation financed in fiscal 1956 a total of 2,071 long-term and short-term graduate traineeships to strengthen and expand the Nation's resources for the rehabilitation of handicapped people.

7. Department of Commerce

The Department of Commerce administers two programs providing aid to students for professional training. One is the operation of the United States Merchant Marine Academy at Kings Point, Long Island, N. Y., which enrolled 888 cadets in fiscal 1956. The other is aid to cadets at State marine schools. The law allows Federal supply of uniforms, textbooks, and subsistence allowances to 710 cadets annually at these institutions. A majority of the cadets at the State marine schools come from the four States in which these institutions are located (New York, Maine, Massachusetts, and California) and neighboring States.

The Merchant Marine Academy and the State marine schools provide training largely in science and engineering leading to the award of academic degrees.

8. Department of the Treasury

The Coast Guard operates as a service in the Treasury Department except when operating as a service in the Navy in time of war or when the President directs. The Coast Guard Academy is maintained at New London, Conn., for the professional instruction of selected individuals, who become eligible to receive commissions in the service upon graduation from a 4-year course. Academy graduates obtain training comparable to that of graduates of civilian engineering schools, and are awarded bachelor of science degrees. On July 16, 1956, the Academy had an enrollment of 564. The average pay per cadet, including subsistence, is about $1,800 a year.

9. Department of the Interior

The Department of the Interior annually provides aid for the higher education of a small number of Indian students—203 in fiscal 1956. Regulations governing the grants for this purpose have limited the aid to students of one-fourth or more degree Indian blood coming under the jurisdiction of the Bureau of Indian Affairs.

10. Other Agencies and Programs

Some other Federal agencies and programs which contribute to professional manpower development, but not directly or distinctly in the form of aid to students for higher education, are discussed in the followling chapter of this report.

D. FEDERAL SUPPORT FOR SCIENCE STUDENTS

In 1956 the National Science Foundation published extensive data on Federal support for science students during 1954.

1. Summary data

The study showed that in that year the Federal Government gave financial support to a total of nearly 390,000 students in higher education, mostly veterans, at a cost exceeding $390 million. The Government aided about 345,000 or more than 1 of every 6 undergraduates, and 43,000 or more than 1 of every 5 graduate students pursuing courses leading to advanced degrees in all fields of learning, and well over 1,000 postdoctoral students. Of the total of nearly 390,000 students about 362,000 or 93 percent were veterans aided under the veterans' educational benefit program.[2]

Approximately 24 percent of the federally supported undergraduate students were studying sciences. Over 48 percent of the graduate students for whom field-of-study data were available were pursuing scientific courses. Approximately 96 percent of those receiving Federal support for postdoctoral training were working in the sciences.

Students in the natural sciences, including engineering, accounted for more than 22 percent of the total number of undergraduate and more than 44 percent of the total number of graduate students receiving Federal assistance.

Less than 2 percent of the undergraduate students and less than 4 percent of the graduate students were pursuing social sciences.

The program of veterans' educational benefits provided most of the Federal financial support for undergraduate students in the sciences, and financed more than 1 of every 4 federally supported graduate students in the sciences.

The average Federal payments to the assisted students (or to the institutions they attended) were: Undergraduates $975; graduates $1,200; postdoctoral trainees $4,000.

Total Federal funds expended for support of students at institutions of higher education by specified fields of study were as follows:

[2] Detailed information concerning inclusions and exclusions is given in the report of the National Science Foundation.

Life sciences	$28,649,000
Physical sciences (excluding engineering)	18,577,000
Engineering	56,001,000
Social sciences	8,110,000
Total sciences	111,377,000
Nonsciences	274,393,000
Field not designated	5,830,000
Total	391,560,000

2. Support of undergraduate students in the sciences

Of the nearly 345,000 undergraduate students who received Federal financial support in 1954, more than 82,400 were enrolled for "major" purposes in the sciences. About 50,000 or 6 out of every 10 of these were in engineering.

About 97 percent of the total number of 345,000 undergraduate students were veterans who were receiving their Federal assistance under the temporary program of veterans' benefits. About 2 percent were holders of Naval Reserve Officer Training Corps (Holloway plan) scholarships. Thus undergraduate eligibility for Federal support was being determined almost exclusively by either past military service or commitment to future military service.[3]

(The Navy's Holloway plan scholarships differ from the traditional contract ROTC programs of the Army, Navy, and Air Force. Neither the Army nor the Air Force has authority to award such scholarships. In 1954 there were about 6,400 students who had received 4-year scholarships under the Holloway plan. Over half of these students were enrolled in the sciences and engineering.)

The Department of Defense in 1954 financed undergraduate training for 2,571 of its civilian employees, of whom more than half or 1,327 were studying sciences—including 900 engineering students.

3. Support for graduate and postdoctoral students in the sciences

Veterans' educational benefits accounted for the Federal financial aid to about 27,000 of the nearly 43,000 graduate students who received some support from the Federal Government in 1954. The Federal Government expended altogether about $50 million in aid to graduate students. Of this amount the payments to veterans amounted to about $24,725,000.

Almost half of the federally supported graduate students were pursuing the sciences.

The largest group of graduate students in the sciences who received Federal aid in 1954 were those employed as research assistants. These persons were working on research contracts or grants awarded to senior investigators at colleges and universities. Fellowships constituted another important form of aid.

Several Federal agencies pay for graduate training of employees in subjects relevant to their duties. In 1954 a total of 3,428 persons received such assistance, of whom 3,403 were training in the sciences.

The military departments in 1954 supported full-time graduate training for over 3,300 officers at a cost exceeding $6,300,000. The Air Force led in graduate training of officers in the physical sciences; the Navy in engineering.

[3] Enrollment in federally operated educational institutions was not taken into account in these data.

In 1954 the estimated number of graduate students in the United States, in all fields of study, totaled 198,933, of whom 42,850, or 21.5 percent received some Federal support. The percentages of graduate students in the sciences who received Federal support in 1954 were as follows:

	Percent
Natural sciences, including engineering	27.6
Social sciences	7.7

CHAPTER IX

OTHER FEDERAL CONTRIBUTORY PROGRAMS

(Toward the Development of Technical and Professional Manpower)

A. INTRODUCTION AND SUMMARY

This chapter deals generally with forms of Federal participation in professional manpower development other than the provision of aid to students for higher education—a contribution already discussed in the previous chapter.

The Federal Government is contributing to professional manpower development in a number of other ways. Some of these are clearly distinguishable from aid to students; others are not so clearly distinguishable. Without attempting to draw definite lines of demarcation in all cases, this chapter reviews, by agency, some of the Federal programs promoting technical and professional manpower development, not already described.[1] It also gives data on Federal funds for education, particularly in science and engineering, and Federal expenditures for scientific research and development involving the use of technical and professional manpower.

Some of the programs through which the Federal Government is directly or indirectly contributing to immediate or long-range technical and professional manpower development, other than by giving financial aid to students for higher education are—

(1) Provision for summer courses for high-school teachers of science and mathematics—Oak Ridge Institute of Nuclear Studies;

(2) Promotion of career development of Federal personnel, particularly in fields of shortages—Civil Service Commission;

(3) Nationwide cooperative extension work in agriculture and home economics—Department of Agriculture;

(4) Operation of a graduate school for scientific and engineering personnel—National Bureau of Standards;

(5) Financing graduate training for a large number of officers in the Armed Forces—Department of Defense;

(6) Provision for professional training for a large number of civilian employees at colleges and universities—Department of Defense;

[1] Principal sources: (1) Armsby, Henry A., Engineering and Scientific Manpower. United States Department of Health, Education, and Welfare, Office of Education, Circular No. 483, August 1956. 48 pp. (2) United States Government Manual, 1956–57. 782 pp. (3) Quattlebaum, C. A., Federal Educational Activities and Educational Issues Before Congress. H. Doc. 423, 82d Cong. 567 pp. (4) Information obtained from a number of Federal agencies, December 1956. (5) Some other sources used are indicated in footnotes.

(7) Furnishing informational and consultant services promotional to technical and professional manpower development—Office of Education, Department of Health, Education, and Welfare;

(8) Administration of Federal funds for land-grant colleges, vocational education below college grade and aid to federally affected school districts—Office of Education, Department of Health, Education, and Welfare;

(9) Operation of a large program of vocational education in penal institutions—Department of Justice;

(10) Provision of basic statistical information concerning manpower—Bureau of Labor Statistics;

(11) Promotion of apprenticeship and other on-the-job training—Bureau of Apprenticeship;

(12) Operation of an education-in-the-sciences program—National Science Foundation;

(13) Formulation of administration policies relating to technical and professional manpower development—Office of Defense Mobilization;

(14) Encouragement of nationwide attack upon problems of education beyond the high school—President's Committee on Education Beyond the High School;

(15) Stimulation of widespread public understanding and support of ways for overcoming obstacles to the training of more qualified scientists and engineers—National Committee for the Development of Scientists and Engineers.

Some of the Federal expenditures which more importantly and directly promote the development of technical and professional manpower are those for the following specific purposes:

(1) Instruction at the land-grant colleges;

(2) Vocational education of less-than-college grade;

(3) Training and research fellowships in the fields of public health;

(4) The Federal contribution to cooperative agricultural extension work;

(5) Academic training of military personnel at civilian institutions and at the service academies;

(6) Education, training, and vocational rehabilitation of veterans;

(7) Fellowships in the sciences;

(8) Training (largely in engineering) for Merchant Marine and Coast Guard personnel;

(9) Nationwide apprentice training.

B. DESCRIPTION OF PROGRAMS, BY AGENCY

1. Atomic Energy Commission

The Atomic Energy Act provides for certain major activities of the Atomic Energy Commission to encourage scientific and industrial progress. These include: (1) conducting, assisting, and fostering research and development; (2) controlled dissemination of scientific and technical information; and (3) promotion of widespread but regu-

lated participation in the development and use of atomic energy for peaceful purposes.

In connection with carrying out these and related responsibilities the Commission has obligations to stimulate and assist in the training of an adequate supply of qualified personnel for the expanding private atomic energy industry and for foreign countries participating in the international cooperation program.

The Commission's programs for meeting immediate requirements include: (1) summer courses for high-school teachers of science and mathematics provided through the Oak Ridge Institute of Nuclear Studies; and (2) on-the-job participation on Commission contractor programs by industrial employees.

Long-range programs to assist regular academic institutions to assume the bulk of the load for nuclear engineering and science education include: (1) providing for the training of faculty members in summer institutes and through participation in the research programs of the National Laboratories; (2) furnishing academic institutions certain facilities and equipment; (3) providing symposia, institutes, and published materials for students and teachers in secondary schools; and (4) developing information concerning the present and future demand for scientists and engineers of different specialities in atomic-energy programs.

2. Civil Service Commission

The Civil Service Commission makes studies, formulates policies, prepares guides, and carries on other activities to promote the career development of professional personnel in the Federal service, particularly in fields in which there are shortages.

3. Department of Agriculture—Federal Extension Service

The Department of Agriculture engages in several activities which directly or indirectly contribute to development of technical and professional manpower. Of special interest in the present study is the Federal Extension Service.

Cooperative extension work in agriculture and home economics is carried on by the Department of Agriculture with the aid of the State agricultural colleges. Federal, State, and county governments share the cost. The work consists of practical instruction and demonstration in agriculture and home economics given to persons not attending or resident at educational institutions. Instruction is generally at the secondary or postsecondary level.

The Federal Extension Service functions as an administrative and coordinating organization for the nationwide system of cooperative extension work and administers the various acts of Congress relating to extension work. It is responsible for the overall planning and direction, including determination of policies and procedures, the development of technical subject matter, the conduct of field studies, training of extension workers, and preparation and distribution of educational and informational materials.

4. Department of Commerce—National Bureau of Standards

The National Bureau of Standards contributes to professional manpower development through the operation of several training programs for its scientific and engineering personnel. These include the

graduate school, the junior scientist-engineer program, postdoctoral research fellowships, and seminars, and colloquia.

In operation since 1908, the graduate school has provided exceptional educational opportunities principally for Bureau personnel, but also for other persons employed full time in the Washington, D. C., area. Individuals possessing the proper educational qualifications for enrollment have been able to further their scientific education and to obtain master's and doctor's degrees. Besides out-of-hours courses, the school offers special courses during the working day, for the purpose of increasing efficiency and revealing potentials for more advanced work. The school provides an average of about 40 courses a year. The enrollment is about 1,000 persons annually.

The junior scientist-engineer program of the bureau is designed to give especially well-qualified student employees preparation for future professional careers. The selected young people participate in a planned program of orientation, supervised on-the-job training assignments and discussions with trainee advisers appointed from the technical divisions.

National Research Council-National Bureau of Standards research associateships were initiated in 1954. The program provides advanced training through Bureau-sponsored research, to a small number of highly selected young scientists who have shown promise of becoming creative leaders in basic research.

Besides these programs, the Educational Committee of the Bureau sponsors many seminars and colloquia on various specialized aspects of scientific subjects.

5. Department of Defense

The preceding chapter has listed the contributions to professional manpower development made by the Military, Naval, and Air Force Academies, the Army, Navy, and Air Force ROTC, and (indirectly) by the Department of Defense through research contracts.

The military departments also finance graduate professional training for a large number of officers. In 1954 these departments supported full-time graduate training for over 3,300 officers and postdoctoral training for 97 officers at a combined cost exceeding $6 million. Over half of the officers benefiting under the graduate training programs were pursuing studies in the sciences.

Many civilian professional employees of the Department of Defense are given training at various universities in subjects related to their work. During the fiscal year 1955 approximately 5,000 engineering and scientific personnel participated in such training. Cooperative training programs also have been instituted at a number of military installations, whereby undergraduates working for engineering degrees may alternate work at the installations with periods of college instruction.

The programs of the military departments providing professional education and technical training above and below college grade are too numerous and varied for full description in this report. They might constitute an appropriate subject for special study in connection with the problem of professional manpower development. A detailed description of the educational activities of the military departments as of 1950 is contained in House Document No. 423, 82d Congress, entitled "Federal Educational Activities and Educational Issues Before Congress."

6. Department of Health, Education, and Welfare—Office of Education

The Office of Education promotes professional manpower development through informational, consultant, and other services.

Its statistics on enrollments and degrees granted by American colleges and universities are used by agencies concerned with the present and future supply of scientists and engineers.

In conjunction with the American Society for Engineering Education, since 1949 the Office of Education has compiled annual statistics on enrollments and degrees in the field of engineering.

The Office sponsors conferences and other measures to coordinate the efforts of interested agencies and to effect a closer working relationship between educational and noneducational agencies concerned with manpower development.

Among Division of Higher Education projects of significance in relation to the scientific and engineering manpower problem are: (1) A study of the availability and utilization of institutional financial assistance for the academic year 1955–56; (2) a study of college student retention and withdrawal; and (3) a study of the costs students incur in attending college.

The Office of Education administers the funds appropriated for several important Federal educational programs which contribute to the current or long-range development of technical and professional manpower. These include (*a*) Federal funds appropriated for instruction at land-grant colleges, (*b*) Federal funds disbursed to the States and Territories for assistance in the maintenance and operation of schools in federally affected school districts, and (*c*) Federal funds for vocational education of less than college grade.

Some of the projects being undertaken under the Office of Education's cooperative research program [2] relate to problems of technical and professional manpower development. Two of the fields of investigation are "retention and continuation of students in schools and colleges," and "staffing the Nation's schools and colleges." [3]

7. Department of Justice—Bureau of Prisons

The Bureau of Prisons is making a contribution to the development of technical manpower through the operation of educational programs in the 29 Federal penal and correctional institutions. In 1955, over 14,000, or approximately 80 percent, of the prisoners confined were enrolled in some form of organized educational activity. More than 9,970 of these were enrolled in organized vocational training courses, including on-job training in the institutional maintenance and industrial production shops.

The entire vocational training program is financed out of the earnings from the operation of Federal Prison Industries, Inc.

8. Department of Labor

(*a*) *United States Employment Service.*—The Employment Service has developed two activities which are particularly promotional to technical and professional manpower training. One is being carried out by Employment Service counselors, who are stressing long-term

[2] Authorized by Public Law 531, 83d Cong.
[3] Research report. School Life, December 1956, p. 5.

opportunities in scientific engineering, and other professional fields. The Service is supplying pertinent information to schools as well as to individuals.

The other activity is development of aptitude and predicator tests for many scientific occupations. These tests are helpful in discovering talent for training and employment in these fields.

(*b*) *Bureau of Labor Statistics.*—As one of the principal sources of basic statistical and other information concerning manpower, the Bureau of Labor Statistics aids technical and professional training.

Current and recent studies by the Bureau include such titles as: (1) "Educational Requirements for Employment of Biological Scientists, Economists, Actuaries, Geophysicists, Physicists, Geologists, Chemists, Statisticians, and Sociologists," (2) "The Demand for Chemists and Chemical Engineers in the Chemical, Petroleum and Rubber Industries, a Preliminary Report," and "Employment Outlook for Physicists."

(*c*) *Bureau of Training and Apprenticeship.*—With the cooperation of the United States Office of Education and State and local agencies, the Bureau of Apprenticeship administers a program for the promotion of apprenticeship and other training on the job in the skilled trades.

This program provides training generally at the secondary and postsecondary levels. The training is of technical nature, relating to industrial skills and processes. It covers all of the United States and its Territories.

Particular emphasis has been placed upon training in the industries connected with defense. These include the aircraft, shipbuilding, machine-tool, automotive and petroleum industries, foundry and steel mills, mining and railroads. In addition, the Air Force bases, arsenals, and atomic-energy plants have conducted apprentice training under the program. In December 1956 there were about 180,000 registered apprentices in the United States and an undetermined number of unregistered ones, registration being voluntary.

(*d*) *Women's Bureau.*—The Women's Bureau has published several career pamphlets for the guidance of teachers and students in the fields of science. The most recently published one of these deals with mathematics.

9. National Science Foundation

Besides its graduate fellowship and research grants programs described in the previous chapter as providing aid to individuals for professional training, the National Science Foundation is carrying out a number of other activities promoting the development of scientific manpower. These include: (*a*) developing national policies for the promotion of basic research and education in the sciences, analyzing the national scientific effort, and evaluating research programs; (*b*) collecting and analyzing information concerning scientific manpower; (*c*) promoting the exchange and dissemination of scientific information; and (*d*) strengthening science teaching, improving curriculums, and motivating able students to consider careers in science and science teaching.

Through the education-in-the-sciences program the Foundation is undertaking and supporting measures leading toward full development of the Nation's talent, such as (*a*) summer institutes for science

and mathematics teachers, (*b*) conferences of science teachers and research scientists, (*c*) week-long visits by eminent scientists and mathematicians to small colleges, and (*d*) a traveling science demonstration program for small high schools.

The scientific manpower program of the Foundation maintains a register of scientific and technical personnel and a clearinghouse of scientific manpower information. The latter collects, analyzes, evaluates and disseminates information on the supply, utilization, training and need for scientific and technical personnel.

The Foundation also makes surveys and research studies concerning the status of scientific activity in the Nation.

10. Office of Defense Mobilization

The Office of Defense Mobilization bears important responsibilities concerning the development of technical and professional manpower, particularly in the sciences and engineering. The Office is the policy planning and coordinating agency in our national mobilization effort. The fuctions of the Office relate not only to current defense activities but also to readiness for any further national emergency.

The Assistant Director for Manpower is responsible for coordinating all the manpower activities of the Federal Government necessary to achieve and maintain the current and projected mobilization program. He is also responsible for assuring that appropriate manpower actions are taken now which would enable the Nation to move quickly and effectively to full mobilization.

The Science Advisory Committee advises in matters relating to scientific research and development for defense.

The Health Resources Advisory Committee advises and assists on problems of the Nation's health relating to national mobilization.

The Labor-Management Manpower Committee makes recommendations relating to the mobilization, training, and maximum utilization of manpower in the defense program.

The Office of Defense Mobilization has issued a policy statement on training and utilization of scientific and engineering manpower. It urges employers and professional associations of scientists and engineers and educational institutions to take steps designed to improve training and utilization of scientists and engineers.

11. Presidential committees

(*a*) *The President's Committee on Education Beyond the High School.*—In a special message to Congress concerning "our educational system" on January 12, 1956, President Eisenhower expressed his intention to appoint a Special Committee on Education Beyond the High School. He said that the purpose of the Committee would be "to lay before us" all the problems of education beyond the high school and to encourage systematic attack upon them.

On April 19, 1956, the White House announced the appointment of 33 persons to constitute the Committee. The justification for a congressional appropriation to the Committee, requested by the President on May 15, 1956, reads in part as follows:

> Among the problems to be studied by the Committee will be those * * * of meeting shortages of scientists, engineers, and other professionals; and of insuring that students with talent continue their education until they develop to the fullness of their capacities.

Preliminary operations of the Committee began in April 1956, with available Presidential discretionary funds. These were supplemented by the 84th Congress, which appropriated $150,000 to the Committee for the current year and authorized but did not appropriate $650,000 for State conferences.

The Committee submitted its first interim report to the President on November 16, 1956. The report reviewed a number of actions by the Committee which relate to the subject of the present study. Following is an extract from the report:

> The educators and laymen who comprise the President's Committee agreed that the Committee has a twofold function: First, to stimulate informed public discussion that will lead to action; and, second, out of this discussion and the Committee's own deliberations to forge useful recommendations to guide citizens' action in cooperation with institutions and governments to reduce at least some of the major problems. In support of these aims, the Committee has within the past 6 months held 5 Committee meetings and numerous subcommittee meetings; formulated premises to serve as bases for the work ahead; heard views of many educators, informed laymen, and interested groups and made plans to hear many more; gathered a staff to supply and refine needed information and to help implement the Committee's plans; and established a course of action to provoke widespread discussion in every State and region, to identify and bring to the attention of the Nation the most critical problems of post-high school education, and to stimulate action to solve them.
>
> As a part of the whole task, the Committee and its staff have made a series of studies defining the basic problems in the following areas: (1) The demand and need for education beyond the high school; (2) the resources to meet the demand; (3) some of the modifications and improvements that might be applied; and (4) the relationship of the Federal Government to this field of education. A panel of Committee members was assigned to each of these four problem areas to clarify the facts and identify the central issues. New panels will now be formed to focus upon the issues thus identified.
>
> As a first step toward bringing the basic questions to the attention of local groups and stimulating the kind of public discussion that will lead to action, the Committee has set up the machinery for a series of conferences in five regions which together comprise all the States and Territories. These will be convened between January and June 1957. To prepare for the conferences, the Committee arranged for five regional "workshops" organized under the auspices of an organization or institution in each region. These organizations and institutions included the Southern Regional Education Board, the Western Interstate Commission for Higher Education, Radcliffe College, the College of Education at the University of Illinois, and New York University. The "workshops," meeting in October and November 1956, brought together from their respective areas educational and civic leaders who suggested agenda for the regional conferences designed to ensure that they will focus on the major problems relevant to each region. They also set up machinery for organizing and conducting the conferences.[4]

(*b*) *National Committee for the Development of Scientists and Engineers.*—On April 4, 1956, the White House announced appointment of the National Committee for the Development of Scientists and Engineers. President Eisenhower assigned the Committee the task of "increasing the supply and improving the quality of our technological personnel." The President expressed the hope that the Committee will—

> Assist the Federal Government in identifying the problems associated with the development of more highly qualified scientists and engineers.
>
> Enlist the cooperation of all interested individuals and groups in analyzing the problem and developing programs to deal with it, and to take the lead in coordination of interested organizations outside the Federal Government.

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[4] The President's Committee on Education Beyond the High School: First Interim Report to the President, November 1956, pp. 2–3.

Make available to all interested organizations information on effective ways of overcoming the obstacles to the training of more qualified scientists and engineers.

Publicize the problem and possible solutions in order to stimulate widespread public understanding and support.

Activities of the Committee are described in its first interim report and in an accompanying letter from the Chairman to the President dated July 1956, reading in part as follows:

* * * * * * *

The Committee held its organizational meeting on May 15, 1956. At this first meeting the Committee, in addition to determining its method of operation, organized two working groups. The first group was to develop a program for increasing the number and improving the quality of engineering and scientific technicians. The second group was to explore ways and means of encouraging the long-range improvement of science and mathematics programs in the elementary and secondary schools.

These working groups reported at the second meeting of the Committee on June 21–22, 1956. The Committee is now developing action programs to carry out the recommendations approved by the Committee.

The National Committee, at its second meeting instructed the Chairman to organize additional working groups to develop programs looking toward (1) the improvement of teachers and teaching in elementary and secondary schools, (2) the identification and guidance of students with aptitude for science and mathematics in the elementary and secondary school.

The Committee also requested that study be made of the need for, and possible sources of, additional scholarships for high school graduates intending to enter into science and engineering courses in college.

* * * * * * *

12. Selective Service System

In conformity with policies formulated by Congress and by the Office of Defense Mobilization, the Selective Service System has established procedures for the deferment of college students, particularly those studying science and engineering. The procedures emphasize allowing the better students to complete their undergraduate college courses, and also allowing additional deferment of some of them for the pursuit of graduate work. Implementation of this policy promotes the development of professional manpower particularly in fields of known shortages.

The national headquarters of the Selective Service System has repeatedly pointed out, however, that the final authority on the deferment of registrants is the local draft board, subject to the appeal procedures established by law. The local board must determine when each of its able-bodied young registrants must render the 2 years of military service for which he is obligated.

The caliber of students who may qualify for student deferments (class II–S) is set forth in a Presidential directive, Executive Order 10650. New in the situation, and of very considerable importance to the manpower problem, is the special skills Reserve program that was introduced in the Reserve Forces Act of 1955 (Public Law 305, 84th Cong.). This enables scientists and engineers to volunteer for the reserve and to meet their military obligation with only 6 months of continuous service instead of 2 years as formerly. Executive Order 10651 authorizes that these men be screened from the Ready Reserve to the Standby Reserve shortly after their 6 months' military training has been completed, and thereafter they are under the jurisdiction of selective service instead of the military, as long as their reserve obligation lasts. The scientific and professional personnel program of the

Army provides a method of having scientists and engineers apply their specialties in the Armed Forces, and thus make the period of service something less than a total technological loss.

C. FEDERAL FUNDS FOR EDUCATION (PARTICULARLY IN SCIENCE AND ENGINEERING)

One measure of the Federal contribution to technical and professional manpower development would be the total of Federal expenditures for this purpose. General agreement could not be expected, however, with respect to definitions, inclusions and exclusions involved in the computation.

Data are given here on the Federal expenditures for certain programs, most of which have been described in this report. These data have been extracted (in some cases computed) from tabulations contained in a volume published in 1956 by the Office of Education, Department of Health, Education, and Welfare.[5]

On the basis of the information given in this and the preceding chapter the reader may form his opinion as to what extent the Federal funds listed below have been contributory to technical and professional manpower development. It may be said unequivocally that Federal expenditures for education are very largely for vocational education and for professional training, particularly in the sciences and in engineering.

1. Summary of Federal expenditures for education

Following is a summary of Federal expenditures for education for the academic year 1954–55 (the latest year for which such data have been compiled).

Funds administered by the Department of Health, Education, and Welfare	$442,475,407
Funds administered by the Department of Agriculture	229,210,798
Funds for the education of veterans	710,083,657
Other Federal funds for education	179,804,052
Total	1,561,573,914

These figures include programs and distributions which provided Federal assistance in the form of commodities, funds or services for activities in educational institutions or under Federal, State, local, or private educational agencies.

Included are federally assisted research and training programs conducted in educational institutions, and the training of non-Federal research workers and technicians in Federal institutions and under Federal assistance.

Included are programs in which a pupil-teacher relationship exists and for which a Federal department or other agency provides instruction, lectures, tuition, contracts for educational services, school housing, or expenses required by students engaged in educational activities under Federal sponsorship.

Excluded are Federal civilian employee on-duty, inservice training programs provided outside of educational institutions.

Excluded are the extensive and varied basic and specialized training programs for military personnel, except the academic training given

[5] Hutchins, Clayton D. Federal Funds for Education. U. S. Department of Health, Education, and Welfare, Office of Education, Bulltin 1956, No. 5, 163 pages.

such personnel at civilian institutions. Education at the service academies is included.

2. Federal funds for particular programs

Federal funds for certain programs directly or indirectly affecting the immediate or long-range development of scientific, engineering, and other technical and professional manpower were as follows for the academic years specified.

(*a*) Department of Health, Education, and Welfare:	
Federal funds appropriated for instruction at land-grant colleges, 1955–56	$5,051,500
Federal funds allotted for vocational education of less-than-college grade, 1955–56	33,638,330
Federal funds allotted for training and for research fellowship of the Public Health Service, 1955–56	17,302,000
Estimated acquisition value of durable personal property allotted to educational institutions, 1954–55	105,739,398
Fair value of Federal surplus real property transferred to educational institutions, 1954–55	4,270,953
Estimated Federal funds expended in the States and Territories for vocational rehabilitation and training grants, 1955–56	32,075,000
Federal funds disbursed for the construction of school facilities in federally affected school districts, 1954–55	122,767,442
Federal funds disbursed for assistance in the maintenance and operation of schools in federally affected school districts, 1954–55	85,250,689
Federal funds appropriated for Howard University (devoted to the education of Negroes)	5,006,000
(*b*) Department of Agriculture:	
Federal funds allotted for cooperative agricultural extension work, 1955–56	45,475,000
Federal funds allotted for agricultural experiment stations, 1955–56	19,549,708
(*c*) Department of Defense:	
Federal funds allotted for academic training of military personnel at civilian institutions[1] and service academies, 1955–56	25,506,028
Federal funds expended for the education of military personnel while off duty, 1954–55	9,332,584
Estimated Federal expenditures for education of children of military and civilian personnel overseas, 1955–56	21,829,811
(*d*) Department of the Interior: Federal funds expended for the education of Indians in the United States, 1954–55	34,605,624
(*e*) Department of State: Federal funds allotted for educational exchange programs, 1955–56	20,283,809
(*f*) Veterans' Administration:	
Federal funds expended for education and training of veterans (Public Laws 346 and 550) including tuition, equipment and supplies, and subsistence allowance, 1954–55	669,313,855
Federal funds expended for vocational rehabilitation of veterans (Public Laws 16 and 894), including tuition, equipment and supplies, and subsistence allowance, 1954–55	40,769,802
(*g*) Atomic Energy Commission: Federal expenditure for the development of scientists and of new information about atomic energy, 1953–54	19,080,119
(*h*) National Science Foundation: Foundation obligations for basic research, fellowships and education in the sciences, 1955–56	13,416,793

[1] Not including military pay and allowances and the payments to universities under research and development contracts.

(*i*) Other Federal Agencies:

Department of Commerce: Estimated Federal funds expended for the education of merchant marine personnel, 1955–56	$2,748,100
Department of Labor: Federal expenditures for apprentice training, 1955–56	3,150,000
Department of the Treasury: Federal funds allotted for the education of Coast Guard personnel and their dependents, 1955–56	3,226,000
Housing and Home Finance Agency: Amount of college housing loans made through Dec. 31, 1955	160,203,000

It should be emphasized that the extent to which any of these Federal expenditures affects technical and professional manpower development is not exactly determinable, being largely a matter of definition and opinion. These funds undoubtedly affect such development in varying degrees.

D. FEDERAL ORGANIZATION FOR SCIENTIFIC ACTIVITIES

A study of the organization of the Federal Government for science activities, carried out by the National Science Foundation in 1954 and 1955 identified 39 Federal departments and agencies engaged in such activities. All of these programs affect to some extent the development of technical and professional manpower. The departments and agencies listed in the Foundation's report, rearranged in alphabetical order, are—

Advisory Committee on Weather Control
Atomic Energy Commission
Bureau of the Budget (Executive Office of the President)
Civil Aeronautics Board
Council of Economic Advisers (Executive Office of the President)
Department of Agriculture.
Department of Commerce
Department of Defense
Department of Health, Education, and Welfare
Department of Justice
Department of Labor
Department of the Air Force
Department of the Army
Department of the Interior
Department of the Navy
Department of State
Department of the Treasury
Farm Credit Administration
Federal Civil Defense Administration
Federal Communications Commission
Federal Power Commission
Federal Reserve Board
Federal Trade Commission
General Services Administration
Interdepartmental Committee on Scientific Research and Development
Interstate Commerce Commission
National Academy of Sciences—National Research Council
National Advisory Committee for Aeronautics
National Science Foundation

Office of Defense Mobilization (Executive Office of the President)
Post Office Department
Railroad Retirement Board
Securities and Exchange Commission
Smithsonian Institution
Tennessee Valley Authority
United States Civil Service Commission
United States Information Agency
United States Tariff Commission
Veterans' Administration

Detailed information concerning the scientific activities of these agencies, but without special reference to the effects upon professional manpower development, is contained in the 349-page report of the Foundation.[6]

E. FEDERAL FUNDS FOR SCIENTIFIC RESEARCH AND DEVELOPMENT

Federal expenditures for scientific research and development indirectly provide important support for the training of technical and professional manpower in the affected fields, although the exact extent of such support is not known.

With the cooperation of the many Federal departments and agencies having research and development programs, the National Science Foundation has made analyses of the Federal research and development budgets since 1953. Following are some of the more significant data brought out in the Foundation's study for the fiscal years 1955, 1956, and 1957.[7]

Federal expenditures for scientific research and development are estimated at 2.3, 2.4, and 2.7 billion dollars in the fiscal years 1955, 1956, and 1957, respectively. These figures show an increase of almost 7 percent in the fiscal year 1956 over the previous year and an anticipated increase of 12 percent in the fiscal year 1957. Besides the amounts for research and development programs, these estimates include (1) expenditures for administering the programs, (2) other indirect costs such as pay and allowance of military personnel in research and development installations, and (3) expenditures for the increase of research and development plants and other facilities.

Obligations for the same fiscal years, including pay and allowances for military personnel but excluding obligations from Department of Defense procurement and production appropriations, have been estimated at 2.3, 2.8, and 2.9 billion dollars. These amounts indicate an upward movement on fiscal 1956 over fiscal 1955 of more than 22 percent, and an anticipated increase in fiscal 1957 of over 5 percent. The increases are expressed in terms of current prices. About 85 or 90 percent of the total is expended or obligated or planned for research and development and the remainder for the expansion of plants for research and development.

About 99 percent of the total Federal expenditures and obligations for research and development is attributable to eight agencies, namely,

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[6] National Science Foundation. Organization of the Federal Government for Science Activities. Washington, Government Printing Office, 1956, 349 pages.

[7] National Science Foundation. Federal Funds for Science. V. The Federal Research and Development Budget Fiscal Years 1955, 1956, and 1957. Washington, Government Printing Office, 1956, 47 pages.

the Department of Defense; the Atomic Energy Commission; the Department of Health, Education, and Welfare; the Department of Agriculture; the National Advisory Committee for Aeronautics; and the National Science Foundation. The Department of Defense and the Atomic Energy Commission rank first and second, respectively, in the amounts of funds administered.

The approximate distribution of the research dollar among the major fields of science in the fiscal years 1955, 1956, and 1957 is 87 cents for the physical sciences including engineering sciences, 11 cents for the life sciences, and 2 cents for the social sciences.

The dominant position in the Federal scientific research budget is occupied by applied research and development; but basic research is growing in terms of Federal funds provided for this purpose.

In the fiscal year 1956, Federal obligations for research and development were distributed among performances components as follows: Work within the Government's own laboratories and facilities, 47 percent; profit organizations, 38 percent; educational institutions, 13 percent; and other organizations, slightly more than 2 percent.

CHAPTER X

CONTRIBUTIONS OF NONGOVERNMENTAL ORGANIZATIONS

A. INTRODUCTION AND SUMMARY

A thorough canvassing of all contributions made by corporations, foundations, societies, and other nongovernmental organizations to the development of professional manpower would be too voluminous an undertaking to be carried out as a part of this study. Extensive investigation has not revealed a source of comprehensive information on this subject. However, numerous publications have been found containing some data, usually concerning the programs of one or more corporations or foundations.

This chapter brings together and digests selected recently published materials bearing on the subject. Because of the different dates and other considerations, the materials cannot be fitted into a clear-cut, overall picture. However, the chapter summary attempts to impart a general conception of what nongovernmental organizations are doing to promote professional manpower development.

For two reasons, this account emphasizes contributions to training in the fields of science and engineering. One of the reasons is that manpower development in these fields is the principal concern of this entire study. The other reason is that altogether the contributions made by nongovernmental organizations emphasize manpower development in scientific fields.

For the purpose of this study, aid to higher education, to institutions of higher education, and to college and university students in general is considered promotional to the development of professional manpower. The exact degree to which such aid is promotional to professional manpower development is incalculable.

College reliance on corporate aid

More than ever before our colleges are relying upon corporate support. In 1956 industrial and business concerns invested an estimated total of $100 million in higher education. However, our colleges and universities must have much greater financial aid if they are to meet the Nation's needs for educated manpower.

Some individuals and organized groups are fearful that increased corporate support of higher education will lead to undesirable corporation influence over it.

Nature of corporate support

While some corporations have established foundations to administer aid to higher education, others are in the midst of formulating policies for such aid. Policy considerations involve such questions as whether it should be given to "have" or "have not"

institutions, and whether it should be given to tax-supported as well as privately supported ones. A study showed corporation preferences of forms of aid to be, in the order named: (1) Funds for current operation, (2) funds for special services, (3) capital funds, and (4) student aid funds. Outstanding among criteria governing corporation interest are (1) location of company plants, employments, or markets in relation to the eductaional institutions, and (2) the institutional sources of the corporation's own personnel.

Some corporations evidence interest in only immediate benefits to themselves from support given to higher education. There is a trend toward interest in long-range and national effects.

National Merit Scholarship Corp.

Much publicity has been given the National Merit Scholarship Corp., which began operating in 1955 with $20 million—the largest sum ever devoted to scholarships. However, soon after the announcement of the grants the Educator's Dispatch pointed out that, although a heartening event in American education, the available funds showed "how big the need, how few the resources." In order to maintain 4,000 men and women in college, an eventual aim of the corporation, the fund must be built up by many more corporate grants.

Other corporate programs

Other corporations and foundations have recently announced large and varied programs of aid to higher education. Some of the largest recent grants have been: Esso Education Foundation—$1,067,900 for 1955–56; United States Steel Foundation, Inc.—$1,150,000 for 1956–57; Shell Companies Foundation, Inc., and Shell Oil Co.—$450,000 for 1955–56; Owens-Illinois Glass Co.—$534,000 (announcement of May 1, 1956); Radio Corporation of America—$572,000 for 1955–56.

Some of the forms of aid to higher education provides by these grants (within limitations of the grants) are:

(1) Corporation matching of the gift of any employee to a privately endowed, accredited college or university.

(2) Four-year scholarships and grants-in-aid to persons nominated by employees of the corporation, preferably relatives of the employees.

(3) Direct grants (for operating expenses) to selected privately supported institutions, broadly distributed.

(4) Grants (for capital funds and operating expenses) through associations, such as the United Negro College Fund.

(5) Unrestricted grants to privately supported institutions selected according to several criteria, such as institutions from which persons in the corporation's management have graduated.

(6) Grants to institutions for faculty salaries according to the number of graduates of each institution in the company's employ.

(7) Grants to specified departments of privately supported institutions for research in designated, broad scientific fields.

(8) Full-term fellowships at tax-supported and privately supported institutions.

(9) Summer fellowships at designated institutions, for outstanding science and mathematics teachers.

(10) Summer jobs for science and mathematics teachers from high schools in or near communities in which the corporation is operating.

(11) Grants to privately supported colleges and universities in specified States.

(12) Fellowships in specified fields of interest to the corporation.

Trend of corporate aid to students

A recent sampling study showed a net increase in corporation outlay for student aid over a 2-year period. The study also indicated development of a growing "appreciation of the wisdom of such aid at the undergraduate level."

Pros and cons of corporate aid

Arguments for corporate contributions to the support of higher education have included these: (1) The dual system of American higher education—tax-supported and gift-supported—should be maintained. (2) Gifts made by corporations to higher education yield returns of value to the corporations, namely, gains in goodwill and prestige.

Among arguments against corporation support of higher education are: (1) Such gifts may be embarrassing to corporations because they require choices or discriminations. (2) Corporate gifts may stimulate charges of "big business" control of education.

Activities of some agencies and societies

The National Science Teachers Association recently announced having obtained the cooperation of a number of industrial concerns in a program to promote technical and scientific training. The program calls for employment of high-school science teachers in industrial plants during the summer months.

Some of the other nongovernmental agencies and societies which in various ways are promoting the development of professional manpower, particularly in the fields of scientific and engineering are: the National Academy of Sciences-National Research Council (a quasi-official agency), the American Association for the Advancement of Science, the National Manpower Council, the American Society for Engineering Education, the Engineers Joint Council, the Engineering Manpower Commission, the Scientific Manpower Commission, the American Chemical Society, the Manufacturing Chemists Association, the National Education Association, the Future Scientists of America Foundation, the American Medical Association, and the Association of American Medical Colleges.

Contributions made by these agencies and societies to skilled and professional manpower development include such activities as:

(1) Prorating fellowship programs.
(2) Rendering expert advisory and consultation services.
(3) Promoting the use of scientists in teacher training.
(4) Conducting and publishing manpower studies.

(5) Giving aid to vocational guidance in high school.
(6) Campaigning for increase of engineering students.
(7) Organizing conferences on scientific personnel problems.
(8) Sponsoring teacher institutes.
(9) Providing "curriculum enrichment" materials.
(10) Developing programs to attract students into training to become teachers.
(11) Organizing efforts to attract youth into training for careers in science.
(12) Publication of materials to increase the competence of health personnel.

Proposed activities of nongovernmental organizations

In a recent article, a corporation executive discussed what technical societies, the colleges, and industrial concerns should do for the production of more and better technical personnel. Some of his suggestions were (1) for technical societies—to give aid in vocational counseling of high-school students; (2) for the colleges—to offer summer sessions for high-school teachers; (3) for industrial organizations—to encourage their technical personnel to help locally to increase the attractions of teaching and to promote stimulating instruction in science.

B. COLLEGE RELIANCE ON CORPORATION SUPPORT

The increase of college reliance on corporations for financial support was reported in the New York Times of January 13, 1957.[1]

The information given may be summarized as follows:

In 1956 business and industrial concerns gave an estimated total of $100 million—their largest annual contribution—to higher education. However, in order to meet current and future needs the Nation's colleges and universities must have much greater financial support.

The $100 million estimate represents an increase of $25 million over the 1954 contribution and $60 million above the 1950 contribution.

Total voluntary private gifts to higher education from all sources in 1956 exceeded $500 million. However, the president of the Council in Financial Aid to Education has estimated that the institutions will need more than an additional $500 million each year for the next 10 years "if they are to meet rock-bottom requirements of maintenance and growth." He said some of this increase may come from higher tuition charges, but "much of it will have to come from alumni, business concerns, the professions, foundations, related church bodies—the general public."

The tremendous demand for their products—college educated men and women—has been a principal cause of the college's financial difficulties. Increasing student enrollments have forced expansion of facilities and faculties during a period of rising costs and proportionately decreasing income.

Corporation aid to education started about 40 years ago. Since World War II there has been a great increase of company interest in this matter. Business executives have recognized that the fate of

[1] Buder, Leonard. College Reliance on Industry Rises. New York Times, January 13, 1957, p. 1+.

their companies and the future of the Nation depend in large measure on American education.

Corporations have developed many kinds of programs for their contributions. These involve direct and indirect grants, scholarships, fellowships, and other types of aid, to all kinds of educational institutions.

The rise in corporation contributions and importance attached by educators to this source of support have aroused concern in some quarters. The basis of this concern is fear of corporation influence over the Nation's colleges and universities. Educators have denied such charges.

C. NATURE OF CORPORATE SUPPORT OF HIGHER EDUCATION[1]

1. Divergent policies

Recognition by business of its increasing need for college-trained men and women has found significant expression in corporate financial aid to higher education. Such aid is, however, a new and evolving phase of corporation management.

Some companies have established foundations to develop and administer programs of financial aid to higher education. Other companies have taken steps toward determining their interests in higher education and are formulating policies with respect to their financial support of it.

Some corporations which have adopted a policy of financial aid to higher education in principle have not decided upon ways of implementing that policy. They are considering such questions as: Which are worth helping—that financial aid to inferior ones is relatively the money? Which are doing most to help themselves?

A wide diversity of views and objectives affects corporate giving. Business executives and other people feel that only "good" colleges are worth helping—that financial aid to inferior ones is relatively unproductive. Others think that investment in "have-not" institutions may bring the greatest proportionate returns—that such colleges have the seeds of greatness and often provide educational opportunities to young people who otherwise would be denied them.

Some persons consider that corporate financial aid should go only to private institutions, since tax-supported ones can turn to Government for their financial needs. Other persons would help State and municipal institutions since they may be called upon to render educational services beyond the scope of support available from public funds.

Differences of opinion affecting corporate giving also relate to such questions as: Should aid be given only to 4-year colleges? Would economy in higher education be effected by greater support of junior colleges? Should corporate aid go only to institutions whose own alumni and patrons are actively supporting them?

Most of the colleges and universities need faculty salary and capital funds. Many are seeking funds for scholarships, fellowships, and student loans.

The Council for Financial Aid to Education, Inc., has pointed out that—

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[1] Basic source. Council for Financial Aid to Education, Inc. Aids to Corporate Support of Higher Education, 1955, 25 pp.

There is the same reason for diversity and competition in corporate financial aid to higher education as for diversity and competition in the higher education which it seeks to support.

2. Kinds of funds

The kinds of corporate financial aid to higher education vary widely. The principal present types of funds are—

(*a*) Funds for current corporations: (1) Unrestricted; (2) restricted to support of a special school or department; (3) for added compensation for teachers; (4) for improvements in study and teaching.

(*b*) Funds for special services: (1) research, pure or applied; (2) product-testing; (3) work-study projects; (4) institutes and lectures; (5) faculty consulting service.

(*c*) Capital funds: (1) buildings; (2) physical equipment other than buildings; (3) endowment.

(*d*) Student-aid funds: (1) scholarships (undergraduate); (2) fellowships (graduate); (3) loan funds.

3. Corporation and institutional preferences

On the basis of reports in 1954 from 367 large national corporations, the composite preference of corporations as to forms of financial aid to education is in this order: First, funds for current operation; second, funds for special services; third, capital funds; fourth, student-aid funds.

This showed a change from the general preference for research or other special services expressed 2 years earlier.

On the basis of 1954 reports from 753 colleges, universities, and technical and professional schools, their composite preference as to forms of financial aid to higher education is in this order: First, funds for current operations; second, capital funds; third, student-aid funds; fourth, funds for special services.

The preferences expressed by the institutions showed increasing appreciation of funds earmarked for increase in faculty compensation and for aids to study and teaching. The data also showed greater concern for future capital needs.

4. Criteria of company interest

Corporations determine their own criteria for aid to higher education. At present these criteria are largely: First, the location of plants, employments, or markets in relation to the location of educational institutions. Second, the institutional sources of the corporation's own college-educated personnel. There are many other criteria. The trend is toward a broader national interest.

5. Immediate and long-range benefits

In giving aid to higher education, a number of corporations evidence interest only in immediate and direct benefits. Some of the companies having such interest are inclined to finance special services, such as research, product testing, and special institutes. Others give aid to special kinds or departments of instruction related to their products or services, and provide scholarships for students in specific fields related to the company's product or interests.

There is a growing number of corporations showing interest in the long-range benefits from increasing the range of educated manpower.

6. Illustrative forms of corporate aid

The Council for Financial Aid to Education, Inc., has listed a number of illustrative forms of financial aid to higher education in use or under consideration by corporations in the United States. Among the listed forms are—

(*a*) Grants to institutions in areas in which principal plants, branches, or employments are located—unrestricted funds, also funds designated for purposes such as faculty salary improvements, etc.

(*b*) Sponsored scholarships for undergraduate study—administered by the company or for it by a professional agency, open to qualified applicants, etc.

(*c*) Grants to institutions in area of principal company markets—unrestricted funds to liberal arts colleges, either through State or regional associations, or by individual selection, etc.

(*d*) Grants to institutions which are the principal sources of the company's personnel—unrestricted funds to alma maters of named company executives, etc.

(*e*) Grants for increasing educated manpower—scholarships (including cost-of-education supplement) to selected institutions to be administered by them in accord with their own regulations, etc.

(*f*) Grants expressive of general interest in the future—unrestricted funds to schools and colleges eminent in training for community service or welfare type of professional career, etc.

D. NATIONAL MERIT SCHOLARSHIP CORP. PROGRAM

Recently much publicity has been given to increased corporate financing of scholarships. Particularly the establishment of the National Merit Scholarship Corp. received widespread attention. This corporation began its operations in 1955 with a grant of $20 million from the Ford Foundation, supplemented with $500,000 from the Carnegie Corp., $600,000 from the Sears Roebuck Foundation, and $30,000 from Time, Inc.—totaling the largest single sum ever devoted to scholarship purposes.

However, estimates from various sources concerning the total amount needed for scholarships have generally been several times greater than the total amount currently available from all sources for this purpose.

With respect to prospective financing of scholarships by the National Merit Scholarship Corp., the Educator's Dispatch for September 22, 1955, said:

> The college scholarship plan announced last week by the National Merit Scholarship Corp. may leave the impression that a college education is being underwritten for most able but needy high-school graduates. Actually, the funds provided, although the largest in history earmarked for that purpose, show how big the need, how few the resources.

The Educator's Dispatch pointed out further that in 1956 the corporation expected to provide 350 all-expense scholarships. This would have given each high school of the Nation 1 chance in 70 of getting only 1 of these scholarships.

The corporation hopes eventually to keep 4,000 men and women in college, all expenses paid. But in order to be able to do so many

more foundations, industries, and corporations would have to build up the fund. This scholarship plan is nevertheless a heartening event in American education.

E. SOME OTHER CORPORATE PROGRAMS

Following are details of some other large corporate programs, which give aid to higher education in various ways.[3]

1. The Young & Rubicam Foundation

Total grants in 1956: $100,000.

Gift-matching program: $38,000. Foundation will match gift of any employee to a privately endowed, accredited college or university. Employee need not have attended the benefiting institution. If fund set aside by the foundation for this purpose is not sufficient to cover each gift in full, the foundation will match the first $100 in each case and apply the balance of the fund pro rata to the excess.

Scholarships and grants-in-aid: $62,000. For 4-year scholarships and grants-in-aid. Scholarships range from $200 to $2,000, depending on need. No restriction on colleges or courses of study. Relatives of Y. & R. employees are given preference. In all cases, scholarship applicants must be nominated by Y. & R. employees. Scholarships to non-tax-supported schools are supplemented by grants-in-aid to the school. These grants equal cost of tuition.

2. Esso Education Foundation (Standard Oil Company of New Jersey and affiliated companies)

Total grants for 1955–56: $1,067,900.

Direct grants for operating expenses: $566,000 to 193 privately supported institutions for undergraduate education. Recipients broadly distributed geographically and by types of institutions.

Direct grants for capital expenditures: $200,000 to 11 selected colleges and universities for building and other capital projects.

Indirect grants: $57,000 (capital funds and operating expenses) to the 31 member colleges of the United Negro College Fund, Inc.; $75,000 (operating expenses) to the 80 member medical schools of the National Fund for Medical Education.

Special programs: $99,900 to 10 selected institutions for assistance in carrying on research projects in the physical sciences; $69,500 to 9 colleges and universities carrying on special studies in the field of human relations.

3. Johns-Manville Corp.

Total grants in 1956 and 1957: $100,000.

$50,000 in 1956, and $50,000 in 1957, to a total of 100 accredited, non-tax-supported colleges and universities. Grants vary in size from $500 to $1,000, depending on the size of the student body. Program also includes small grants to the National Fund for Medical Education and the United Negro College Fund.

Criteria for support:

(*a*) Institutions from which members of J-M's management have graduated.

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[3] Council for Financial Aid to Education, Inc., Information Bulletin, November 1956.

(*b*) Institutions from which J-M has received the largest portion of recently employed salaried personnel.

(*c*) Institutions offering best potential source of new employees in specified areas and to meet special requirements.

(*d*) Institutions serving communities where large numbers of J-M employees reside.

4. International Harvester Foundation

Total grants in 1956: $57,000.

To 22 State associations of independent, privately endowed colleges (operating expenses).

Criteria for support:

(*a*) The association of colleges must be in a State or region in which the company is relatively important in the business life of the area.

(*b*) The group must be representative of the 4-year accredited, privately supported educational instituions in the area which it serves.

(*c*) The group must have achieved stability and local area recognition as evidence by the continuous support of local business and other organizations.

5. American Can Co.

Total direct grants for 1956: $300,000.

Earmarked for faculty salaries to be distributed over the next 5 years; $500 will be granted for each alumnus working in the company having five years of service (regardless of rank). (Example: A school having 20 graduates in the company's employ will receive $10,000.) Program includes 176 4-year degree-granting private institutions.

Direct grants are earmarked for faculty salaries to assist in relieving one of the most critical problems in the field of education.—R. F. Hepenstal, treasurer.

Indirect grants: The company makes special grants to the United Negro College Fund and the National Fund for Medical Education.

Student aid and cost grants: 4-year competitive scholarship grants to employees and children of employees covering full tuition to schools of their own choice. Includes cost of education grants of $500 per year to the institution.

Research: The company will make a number of grants for research in designated areas of scientific study.

6. United States Steel Foundation, Inc.

Total grants for 1956–57: $1,150,000.

Direct and indirect grants to institutions: $557,000 (operating expenses) to 219 4-year member schools of liberal arts fund-raising associations in 12 States, to 131 liberal arts colleges, institutes, and universities not affiliated with such associations, to 107 member schools of the 24 fund-raising associations not included above, and to 81 member schools of the National Fund for Medical Education; $340,000 (capital needs) for endowments, buildings, equipment, or other facilities. Recipients: 2 technological institutes, 2 liberal arts colleges, and 3 universities, in varying amounts.

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Fellowships and graduate schools: $150,000 for 2-year graduate fellowships in 20 tax-supported and non-tax-supported institutions in the United States. Institution selects student. Cost of education supplements included; additional cash benefits to married students.

Other grants: To American Association of Colleges and Reference Libraries, St. Louis University Library, American College Fund, American Alumni Council, Commission on Colleges and Industry.

7. Shell Companies Foundation, Inc. and Shell Oil Co.

Total grants for 1955–56: $450,000.

Direct grants: $50,000 (unrestricted), 20 grants of $2,500 each, to 15 non-tax-supported institutions; $9,000 (unrestricted), 18 grants of $500 each, to 14 non-tax-supported colleges and universities; grants supplemental to 18 regular year fellowships.

Grants through associations: $21,000 (capital funds and operating expenses) to the member colleges of the United Negro College Fund, Inc.; $12,500 (unrestricted) to the member medical schools of the National Fund for Medical Education.

Grants to graduate schools: $100,000, 20 grants to 15 departments of non-tax-supported institutions, for use in expanding fundamental research in designated broad scientific fields to promote the acquisition of knowledge, grants are associated with 20 direct grants at same institutions; $12,800, 32 grants of $400 each, to departments of 23 tax-supporting colleges and universities, grants supplemental to fellowships; $9,000, 18 grants of $500 each, to departments of 14 non-tax-supported colleges and universities, grants supplemental to fellowships.

Fellowships and special programs: $94,200, 50 fellowships at 37 tax-supported and non-tax-supported institutions, fellow stipend of $1,500 plus payment of tuition and fees; $100,000, 60 full summer term merit fellowships for special seminars at Cornell and Stanford for outstanding high-school science and mathematics teachers. To teachers; tuition and fees, room and board, travel allowances, plus $500 stipend to make up for loss of potential summer earnings; to institution, cost of conducting seminar.

Other grants: $41,500, special grants to National Science Teachers Association, the council for the Advancement of Secondary Education, Institute of International Education, and others.

8. The B. F. Goodrich Co.

Total grants for 1956–57: $300,000.

Gift-matching program: The company will match gifts up to $500 made by any employee with 1 or more years of service to any college or university, regardless of the extent of his education or his school affiliation.

Four-year scholarships: Maximum of seven per year through the National Merit Scholarship Foundation. Included cost-of-education grants to institutions attended by the scholars.

Tuition sharing: The company will pay 50 percent of the cost of any job-connected courses taken by employees. Included, cost-of-education supplement to the school amounting to 50 percent of tuition.

Research grants: The company will make a number of grants for research in designated areas of scientific study.

9. Owens-Illinois Glass Co.

Four-part program provides—

(*a*) From 12 to 19 scholarships annually for 4 years at 12 universities (5 private, 7 tax-supported), each scholarship to be renewed annually during the recipient's undergraduate course. Choice of school determined by (1) location, (2) performance of alumni now in company's employ, (3) caliber and type of training offered, (4) desire for a balance between public and private institutions. Four-year value of scholarships ranges from $1,120 to $5,525.

(*b*) Summer jobs at O-I plants for O-I scholars, with opportunity to earn $600 per summer for 3 summers.

(*c*) Unrestricted grants to each university to match tuition payments made in behalf of each O-I scholar.

(*d*) Summer jobs for 43 mathematics or science teachers in high schools in or near O-I plant communities, with opportunity to earn $800. (This program supplements grants made to associations of independent colleges in Ohio, Indiana, Illinois, West Virginia, and California.)

Projected costs (approximated):

Scholarships (7-year span)	$149,000
Grants to universities	110,000
Summer jobs for O-I scholars	137,000
Summer jobs for high-school teachers	138,000
Total	534,000

10. Kaiser Steel Corp. and Kaiser Aluminum & Chemical Corp.

Total grants for 1956–57: $115,000.

Grants to institutions:

Kaiser Steel Corp.: $25,000. Grants of not less than $1,000 each to various privately supported colleges and universities in California and Utah.

Kaiser Aluminum & Chemical: $46,000 (unrestricted). Grants of not less than $2,000 to various privately supported colleges and universities in the United States.

Gift-matching program: $10,000. Company will match gift of any employee to his alma mater, private or public. Limits: $1,000 per employee, $10,000 for 1956.

Special programs: Kaiser Aluminum & Chemical: $34,000, to both privately and publicly supported colleges in the United States in the form of restricted fellowships, teaching assistantships, and other operating grants.

11. Radio Corporation of America

Total grants for 1955–56: $572,000.

Direct grants: $26,000 (unrestricted): Grants of $100 to $2,500 to institutions where company employees have enrolled in after-working-hour courses; amount is determined by number of staff attending each institution; $256,500 for research projects, college building funds, and other special projects.

Grants through associations: $7,500 (operating expenses) to United Negro College Fund and National Fund for Medical Education.

Scholarship and other student aid: $26,400 for 33 scholarships to 27 designated and 4 undesignated colleges and universities (28 in the sciences, 3 in dramatic arts, 1 in music, and 1 in industrial relations); amount of each scholarship, $800 annually; $16,500 for cost-of-education supplements ($500 per scholarship) to privately endowed institutions (colleges and universities themselves select candidates, who are approved by the RCA education committee); $168,900 (tuition refund plan) paid out to employees for courses completed in 1955.

Fellowships and cost-of-education supplements: $15,000 ($750 cost-of-education supplement) paid to institution with each of 20 fellowships; $55,000 for 20 fellowships in science, engineering, dramatic arts, and business administration (10 assigned to specific institutions which make their own selections, and 10 for RCA employees selected by supervisors subject to approval by RCA educational committee; value of fellowship, $2,100 for living expenses plus full tuition).

F. TREND OF CORPORATE AID TO STUDENTS

A 2-year comparison of outlay for the support of scholarships and fellowships by 13 selected companies was reported in Chemical Week for May 1, 1954.[4]

The company outlays for scholarships and fellowships varied from $301,000 by Du Pont to $3,500 by American Potash in 1953–54, and from $295,000 by Du Pont to $1,000 by American Potash for 1954–55. The second highest outlay for 1954–55 was $90,500 by Allied Chemical and the second lowest for that year was $1,500 by Visking.

The data showed that in the 2-year period 8 of the 13 companies had slashed their educational allocations while 4 had boosted them. The balance reflected a net increase in outlay for 1954–55 over that for the previous academic year.

The study showed a "growing appreciation of the wisdom of aid at the undergraduate level." Manpower experts had expressed the feeling that plenty of money was already earmarked for graduate fellowships.

Reported new offerings by individual companies included (*a*) a new $15,000 program of 17 undergraduate scholarships provided by American Cynamid Co. to supplement its existing fellowships in chemistry and chemical engineering; (*b*) a new Du Pont allotment of $238,500 to be divided thus—$100,000 to 40 colleges to bolster their science departments; $25,500 in summer research grants for chemistry teachers; $73,000 for graduate teaching fellowships in chemistry; and $40,000 for high-school science and mathematics teachers to pursue master's degrees.

G. PROS AND CONS OF CORPORATION AID

In connection with the consideration of possible Federal action to promote professional-manpower development, some Members of Con-

[4] Trend Between the Lines. Chemical Week, May 1, 1954, p. 46.

gress may be interested in the pros and cons of corporation aid to higher education.

The principal arguments may be summarized as follows:[5]

For—

1. The need and desire to insure the continued flow of college-educated personnel into business and industry and the Nation at large.
2. Maintenance of the dual system of American higher education—gift supported and tax supported. (Higher education, like business enterprise, gains from competition. Private institutions have various advantages of independence. State universities in large part are helped to the maintenance of good standards by the welcome competition of the institutions independent of the State. If higher education were to become a function exclusively of the State, taxloads would be increased enormously. It is less expensive and better to keep the independent colleges and universities independent.)
3. Determination to maintain and strengthen the socioeconomic environment in which free enterprise may function most effectively. This requires diversity and competition in higher education also.
4. The practical value to a company, in terms of public relations values of good will and prestige, of gifts made in its role of "corporate citizen."
5. Promotion of the general welfare of State and Nation increasingly dependent on college-educated men and women.

Against

1. Corporate funds belong in equity to stockholders, and it is a "violation of trust" to disperse corporate funds for any purpose which does not contribute to the "success" of the corporate enterprise.
2. There is still doubt especially among the banks, utilities, and insurance companies as to the legality of gifts to charitable causes which are not directly related to the business of the corporation.
3. Tax-supported education has served our country well in the elementary and secondary schools and at the college level.
4. Contributions to higher education may be embarrassing because choices (discrimination) are inevitable.
5. Large corporations, already "suspect" in the minds of some people, may be charged with undue influence on democratic education—with attempted extension of "control by big business."

H. A COOPERATIVE PROGRAM

On February 13, 1956, the National Science Teachers Association announced having received the cooperation of 44 industrial concerns in a plan to promote the training of scientists and technicians.[6] The firms had agreed to offer summer vacation employment opportunities to high-school science teachers, partly because the industrial execu-

[5] Council for Financial Aid to Education, Inc. Reference book, Corporation Aid to American Higher Education, 1955, pp. I–1, I–1a.

[6] Schools and Industry Spearhead New Program To Recruit High School Students for Technical Careers. News from the National Education Association, February 13, 1955, 3 pages.

tives believed teachers to be in a strategic position to encourage young people to seek technical careers.

Teachers employed by industry during the summer months reported that they welcomed genuine, practical, and realistic identification with scientific enterprise.

A representative of one of the employing concerns stated the objective of the program thus:

> The essential purpose of summer employment is to broaden the teacher's knowledge and appreciation of what is involved in becoming a useful, professional scientist, of what is expected and required of a qualified graduate chemist.

I. ACTIVITIES OF CERTAIN AGENCIES AND SOCIETIES

In August 1956, the Office of Education, Department of Health, Education, and Welfare, published a circular on Engineering and Scientific Manpower.[7] Included in the circular is information on the activities of some of the nongovernmental agencies and societies presently concerned with scientific manpower development.

Following is a digest of the information given on current nongovernmental organizational activities bearing on the subject of this study, with some additional information from other sources, indicated in footnotes.

1. National Academy of Sciences—National Research Council (a quasi-official agency)

The National Research Council was organized in 1916 by the National Academy of Sciences under the congressional charter of the Academy.[8] The Council maintains an Office of Scientific Personnel, which has operated a number of fellowship programs and engaged in other activities promoting the development of scientific manpower.

Current activities of the office include (*a*) operation of a program concerned with bringing to the United States a number of European scientists at the doctorate level for research in American institutions of higher education, (*b*) conduct of research on selection techniques, (*c*) maintenance of a file on persons receiving doctorates from American colleges and universities, (*d*) cooperation with other groups concerned with manpower problems, (*e*) advisory and consultation services to Federal agencies.

2. American Association for the Advancement of Science

This association was founded in 1848 and incorporated in 1874. About 250 scientific organizations are officially associated or affiliated with it.[9]

The association is carrying out two special projects concerned with engineering and scientific manpower. These are (*a*) a science teaching improvement program, for which the Carnegie Corp. has granted funds, and (*b*) a traveling libraries projet, for which the National Science Foundation has provided funds.

The science teaching improvement program promotes greater use of scientists in teacher preparation, and other objectives. The traveling

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[7] Armsby, Henry A. Engineering and Scientific Manpower. U. S. Department of Health, Education, and Welfare, Office of Education, Circular No. 483, August 1956.

[8] United States Government Manual, 1956–57, p. 547.

[9] Scientific and Technical Societies of the United States and Canada. Sixth edition, p. 26.

libraries project is concerned with an experimental distribution and evaluation of student use of science books in small high schools.

3. National Manpower Council

Appointed by President Eisenhower when he was president of Columbia University, the National Manpower Council is financed by the Ford Foundation. It is composed of 15 leaders of business, management, labor, agriculture, science, and education. The objectives are—

> to evaluate manpower problems of crucial concern to the United States in this enduring emergency and to recommend constructive policies for their solution.

The Council has issued a statement on manpower problems and policies (1951), and has published five books dealing with manpower. At the time of this writing it is engaged in studies of womanpower, and governmental manpower problems and policies.

4. American Society for Engineering Education

This society was organized in 1893. Its purpose is the advancement of education in all of its functions pertaining to engineering and allied branches of science and technology.[10]

The society appointed its manpower committee in December 1946. For the first 3 years the committee was concerned with the possibility of a surplus of engineers. Since then the committee has been continuously concerned with the prospect of a long-continuing shortage of engineers.

The functions of the committee include (*a*) collection and interpretation of information (for the American Society for Engineering Education and for engineering schools) concerning the current and future supply of and demand for engineering graduates, (*b*) promotion of activities within the engineering schools designed to insure an adequate number of well-qualified graduates.

The committee is engaged in comprehensive study of ways and means of improving the quality and effectiveness of engineering graduates—a net result comparable to an increase in the number of engineers.

5. Engineers Joint Council

This is a nonprofit organization formed in 1941 by leading national engineering societies, representing basic branches of the profession. The council represents about a dozen constituent national engineering societies. One of the several announced objectives of the council is to advance the science and profession of engineering.

The council has a special surveys committee. Its function is to attempt to survey the supply and demand figures each year for engineering graduates and to make periodic surveys concerning the economic status of the engineers.

6. Engineering Manpower Commission

This commission was established by the engineers joint council in September 1950. The commission is supported by private subscription. One of its objectives closely related to the subject of the present study is that of giving aid in maintaining the supply of adequately trained engineers through guidance work in high schools and improvement of the quality of engineering education in the colleges.

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[10] Scientific and Technical Societies of the United States and Canada. Sixth edition, p. 89.

Some of the activities of the commission are: (1) conduct of a vigorous campaign toward stemming the tide of decreasing enrollment in engineering colleges, (2) publication of a series of newsletters to keep industrialists informed concerning the critical shortage of engineers, (3) conduct of a campaign to interest companies in pointing out in their advertising the existing opportunities for qualified persons in the engineering profession.

7. Scientific Manpower Commission

This commission, created in the spring of 1953, is supported by 10 major professional groups. Its objectives relating to scientific manpower development include (*a*) cooperating with sponsoring and educational associations and with industry in furnishing career guidance counselors, (*b*) organizing and participating in conferences and other activities concerned with the problem of recruiting, training, and utilizing scientific personnel.

The commission cooperates closely with the Engineering Manpower Commission. The two commissions carry on some joint activities.

8. American Chemical Society

This society was organized in 1876, and incorporated under Federal charter in 1937. It is composed of more than 77,000 chemists and chemical engineers. Its board of directors, division of chemical education, its council, and its 149 geographic sections all have a part in the society's manpower and education programs.

The board of directors has a committee on education and students, which deals with the training of personnel for the chemical profession.

The division of chemical education publishes a journal, sponsors teacher institutes and conferences, administers a testing program, and otherwise promotes projects relating to education. The council of the society has a committee on chemical education which directs the vocational guidance and student affiliate programs of the society.

9. Manufacturing Chemists' Association, Inc.

This association, established in 1872, is the world's oldest chemical trade organization. It represents "more than 90 percent of the productive capacity of the United States chemical industry."

In July 1956, the association launched a nationwide, 5-year education program to encourage more of America's youth to follow careers in science—with emphasis on chemistry. The program will cost an estimated $1 million, and will affect all levels of education.[11]

The science education program has three objectives: (*a*) To inspire qualified students to follow science as a career; (*b*) to assist educators through the development of science-teaching aids and "curriculum enrichment" materials; (*c*) to aid and encourage science teachers and education administrators toward the goal of increasing their numbers, their effectiveness, and their prestige.

10. National Education Association of the United States

This is a voluntary association of about 660,000 teachers and school administrators. It includes among its affiliates the State and ter-

[11] Information obtained from the Manufacturing Chemists Association, Inc.

ritorial education associations having a combined membership of about 1,139,000 teachers.[12]

The NEA has taken the lead in studies of teacher supply and demand and in efforts to upgrade requirements for teaching certificates and to develop a nationwide program for balancing teacher supply and demand.

The National Commission on Teacher Education and Professional Standards of the NEA has issued publications dealing with such matters as developing programs to attract students into teacher education, and the implications of personnel policies in industry for education.

11. Future Scientists of America Foundation

This foundation was established in 1952 as an activity of the National Science Teachers Association. It operates under an administrative committee broadly representative of the physical sciences, engineering, biological sciences, high school and college teaching, and science teacher education.

The program of the foundation is aimed at increasing the numbers of able students coming out of high schools with an interest in science and adequate preparation to enable them to pursue this interest successfully in colleges and technical institutes. The foundation is providing basic services toward coordinating the efforts of scientists, science teachers, industrial organization leaders, and others interested in attracting capable youth into technical and professional careers.

12. American Medical Association

The AMA was organized in 1847. It now has about 147,000 members. Its purpose is to promote the science and art of medicine and the betterment of public health.[13]

AMA activities toward insuring an adequate supply of well-trained physicians for the future in the United States include (*a*) inspection and approval of medical schools, (*b*) active encouragement of expansion of medical schools and facilities and development of new medical schools in certain areas, (*c*) advocacy of postgraduate education and refresher courses for physicians, (*d*) publication of materials to aid health personnel to increase their professional knowledge and competency.

13. Association of American Medical Colleges

This association was founded in 1876 with the basic objective of advancing medical education. Among its contributions to the development of scientific manpower (in the field of medicine) are (*a*) annual compilation and publication of the admission requirements of our medical schools, (*b*) maintenance of a personnel exchange service for medical college teachers and schools, (*c*) periodical compilation and distribution of a list of fellowships, funds and prizes available for graduate medical work in the United States and Canada.

14. Other organizations

On October 15, 1956, the American Association for the Advancement of Science issued a report concerning the activities of a number

[12] Information obtained from the National Education Association.
[13] Scientific and Technical Societies of the United States and Canada. Sixth edition, p. 71.

of private and governmental organizations in the teaching and recruitment of scientists and teachers of science, including mathematics. A list of nongovernmental organizations whose activities of this nature are described in the report follows:[14]

(1) American Association for the Advancement of Science; (2) American Association of Physics Teachers; (3) American Chemical Society; (4) American Institute of Biological Sciences; (5) American Physiological Society; (6) Committee on Regional Development of Mathematics; (7) Council for Basic Information; (8) Engineers Joint Council; (9) Joint Board on Science Education; (10) Manufacturing Chemists Association; (11) Mathematical Association of America; (12) National Association for Research in Science Teaching; (13) National Association of Secondary School Principals; (14) National Council of Teachers of Mathematics; (15) National Science Teachers Association; (16) Scientific Manpower Commission; (17) United States Chamber of Commerce.

J. PROPOSED ACTIVITIES FOR NONGOVERNMENTAL ORGANIZATIONS

In a recent article, Mr. L. P. Whorton, director of production research, Atlantic Refining Co., discussed what industrial concerns, technical societies, and the colleges should do for the production of more and better technical personnel. Some of the ideas advanced by Mr. Whorton with respect to organizational activities are:[15]

The primary need is for quality, not quantity. Colleges should weed out inferior prospects to make room for those able to meet today's exacting demands.

There is need for better high-school preparation for college work in technical subjects, and for better counseling to interest secondary-school students in scientific careers. Technical societies can provide much of the additional counseling needed. With financial aid from industrial concerns, colleges can help by offering summer sessions for high-school science teachers.

Industrial organizations should: (1) encourage their technical personnel to participate in community activities aimed at helping the local high-school teachers and pupils—such as counseling, promoting the attractiveness of teaching as a career, and helping to provide stimulating instruction in science; (2) encourage their technical personnel to participate in the activities of scientific societies; (3) employ high-school teachers for summer work in technical surroundings; (4) increase their support to higher education through grants-in-aid to institutions, and financing scholarships and fellowships; (5) maintain a proper difference in pay between professional and nonprofessional personnel.

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[14] American Association for the Advancement of Science. Interagency News Letter, October 15, 1956. Compiled by I. E. Wallen, 50 pp.

[15] Whorton, L. P. More—and Better—Engineers Needed. The Oil and Gas Journal, Jan. 30, 1956, pp. 120–121.

CHAPTER XI

RELEVANT LAWS AND PROPOSALS, 84TH CONGRESS

A. INTRODUCTION AND ANALYTIC SUMMARY

The scope and variety of considerations given to education in the 84th Congress have reflected a growing national concern with problems in this field. A review of the wide range of relevant bills enacted, proposals introduced, discussion in committee hearings, statements in reports from committees, formal speeches, casual remarks on the floor, and insertion of articles and excerpts in the Congressional Record supports this conclusion.

A study of all this material reveals a recurrent congressional recognition of the Nation's need for the development of scientific, engineering, and other professional manpower. The 84th Congress enacted a number of laws which may affect the development of such manpower.

Laws enacted by the 84th Congress bearing on this subject are concerned with (*a*) Federal encouragement of nationwide discussion of all the problems of education beyond the high school; (*b*) Federal promotion of the training of professional personnel in the fields of public health, commercial fishing, and water pollution; (*c*) provision of equipment for institutions providing training in specified scientific fields; (*d*) extension of veterans' educational benefits, which largely include professional training; (*e*) expansion of the college housing loan program; and (*f*) other matters. In addition, enactments such as those providing for flight instruction during ROTC programs, raising the status of the Merchant Marine Academy, and establishing a National Library of Medicine, importantly relate to the development of professional manpower in the affected fields.

Outstanding among fiscal 1957 appropriations directly or indirectly affecting this problem or some phase of it are the following:

Office of Education, Department of Health, Education, and Welfare, salaries and expenses	$5,270,000
Land-grant colleges and universities	5,051,000
Vocational education below college grade	31,442,000
National Science Foundation	40,000,000
Veterans' education and rehabilitation	733,510,000

A number of other appropriations bearing on the immediate or long-range development of professional manpower are mentioned in this chapter.

Relevant bills introduced in the 84th Congress, but not enacted, vary widely in the nature of their relationships to the subject of this study. Such bills contain proposals for (*a*) a broad program of national scholarships, (*b*) Federal scholarships in specified fields, (*c*) Federal loans to students, (*d*) Federal funds for facili-

ties for professional training in certain fields, (*e*) income-tax deduction for educational expenditures, (*f*) further extension of veterans' educational benefits, and (*g*) other measures described in this chapter.

A thoughtful consideration of all of this enacted and proposed legislation leads to the conclusion that it represents significant actual and potential Federal contributions to the development of the Nation's professional manpower. However, there are important counterbalancing considerations.

None of the legislation deals with the problem as a whole. Nevertheless, some of the laws and bills do contain policy statements recognizing the shortage of professional manpower in general or in specific fields, implying that there is a Federal responsibility for action toward alleviating the shortage.

For example, the National Scholarship Act of 1956 declared that—

> The Congress hereby finds that there is a serious shortage of teachers and scientists in the United States at the present time, and that such shortage represents an increasing threat to the general welfare and the national defense and security of the United States.

(This bill was not enacted.)

The whole consideration of bills of this kind, both inside and out of Congress, is undoubtedly affected by the absence of overall, clearcut constitutional or other statutory provision governing what the Federal Government should or should not do in educational matters. Proposals for broad Federal action dealing with educational problems are often advanced with hesitation, or not at all, because of their involvment with highly controversial questions concerning Federal and State responsibilities in education, and particularly with the perennial controversy over the possibility of Federal control over education.

As a whole, the laws and bills emphasize development in certain specified (mainly scientific) fields. Prior Federal legislation also emphasized education in these and/or closely associated fields. This observation leads to the conclusion that the national interest calls for congressional consideration of the *total effects* of such legislation upon education in the United States, and raises questions such as the following concerning enacted and proposed bills:

1. Will legislation of this kind lead to overemphasis of certain subjects in American education?
2. Does the proposal under consideration offer piecemeal or a comprehensive solution of the problem?
3. Has it the backing of a particular pressure group? If so, what is this group, and what are its motives?
4. What policies are desirable or undesirable in Federal promotion of education?
5. Is the existing Federal legislation adequate and appropriate to meet the national need?
6. Will the proposal accomplish its objective, or merely lead to a substitution of Federal money for available private or State funds?
7. If this is not a sound proposal, what kind of substitute or additional legislation, if any, should be enacted?

These are questions before the 85th Congress. The purpose of the following digest and discussion of laws and bills is to provide a part of the basic information which the Congress needs in order intelligently to consider the answers.

B. LAWS ENACTED BY THE 84TH CONGRESS

A number of measures enacted by the 84th Congress relate fairly closely to the general subject to this study or some part of it. Such laws include the following.

1. Committee on Education Beyond the High School

H. R. 12237 (Public Law 813), introduced by Representative Carl Elliott of Alabama, was approved July 26, 1956. This act established a statutory basis for the work of the President's Committee on Education Beyond the High School, which had been appointed by President Eisenhower on April 19, 1956.

In a special message to Congress concerning "our educational system" on January 12, 1956, President Eisenhower had said that the work of this committee would be—

> to lay before us all the problems of education beyond high school, and to encourage active and systematic attack upon them.

On May 15, in requesting an appropriation for the work of the committee, the President had said that—

> Among the problems to be studied by the committee will be those * * * of meeting shortages of scientists, engineers, and other professions; and of insuring that students with talent continue their education until they develop to the fullness of their capacities.

The close relationship of Public Law 813 to the subject of this report is shown in the preamble to the law, which reads as follows:

> The Congress hereby finds and declares that the impending great increases in enrollment in higher education institutions, the great national need for increased numbers of scientists, engineers, teachers, technicians, nurses, and other trained personnel, the rapid changes in conditions which necessitate additional education for many adults, and the dependence of the national security on the research and advanced preparation provided by educational institutions, and the impact of the military services on youth, combine to make it imperative that immediate stimulus be given to planning and action throughout the Nation which will meet adequately the needs for education beyond the high school.

The act authorizes an appropriation of $650,000 to encourage and assist the States to provide committees on education beyond the high school. The committees are to be composed of educators and other interested citizens to consider educational problems beyond the high school and to make recommendations for appropriate action to be taken by public and private agencies at local, State, regional, and Federal levels, *including the possibility of coordinating compulsory military service with established programs of institutions of higher education.*

The Federal funds shall be allotted to the States on the basis of their respective populations except that each participating State shall have a minimum allotment of $7,500.

The act also authorizes the appropriation of such sums as the Congress may determine for the administration of the act and the expenses of the President's Committee on Education beyond the High School. It requires that the committee insofar as practicable shall

be composed of educators and educational administrators fairly representative of the large and small universities and colleges and geographically representative of the Nation. It requires that the final report of the President's committee be submitted in writing to the President and the Congress not later than December 31, 1957.

2. Training of public health personnel

The Health Amendments Act of 1956 (S. 3958), introduced by Senator Lister Hill, of Alabama, and others, was approved on August 2, 1956, and became Public Law 911, 84th Congress. The act provides additional means of stimulating the training of more professional public-health personnel.

Title I authorizes the appropriation of such sums as the Congress may determine for a 2-year Federal program of traineeships for advanced training for physicians, engineers, nurses, and other professional health personnel.

The Surgeon General may award these scholarships either directly or through grants to training institutions. The funds appropriated for traineeship may be used only to defray the educational expenses of the individuals awarded the traineeships. The law provides for a special conference to appraise the program and make recommendations which the Surgeon General would transmit to Congress not later than January 1, 1959.

Title II provides for grants by the Surgeon General to public and nonprofit institutions training nurses, for the awarding of traineeships to individuals selected by these institutions to receive training in nursing. The funds may be used for tuition and fees and a stipend and allowances for travel and subsistence expenses. The law provides for a conference after the second year to consider modifications of the program.

Title III extends with new emphasis the existing Federal-State program of vocational education (under the George-Barden Act). The title provides for a 5-year program of categorical grants to States for the extension and improvement of practical nurse training.

For the first 2 years of this program the act requires State expenditure of at least one State dollar for every three Federal grant dollars, and thereafter dollar for dollar matching. Appropriations for such grants are limited to $5 million annually.

3. Professional personnel in the fishing industry

S. 2379 (Public Law 1027), introduced by Senator Frederick G. Payne, of Maine, and others, was approved August 8, 1956. It authorizes the Secretary of the Interior to make grants to public and nonprofit private universities and colleges in the several States and Territories for such purposes as are necessary to promote the production of professionally trained personnel (including technicians and teachers) needed in the field of commercial fishing. For these purposes it authorizes an appropriation of $550,000 annually.

The act requires that the Secretary of the Interior in distributing the grants shall take into account the extent of the fishing industry within each State as compared with the total fishing industry of the United States, and other factors.

The law also amends the Vocational Education Act of 1946 (the George-Barden Act) by authorizing $375,000 in grants to the several

States and Territories for vocational education in the fishing trades and industries and distributive occupations therein.

4. Research and training to control water pollution

S. 890 (Public Law 660) introduced by Senator Edward Martin of Pennsylvania and others, was approved on July 9, 1956. It extended and strengthened the Water Pollution Control Act.

Section 4 of Public Law 660 directs the Surgeon General to encourage and assist research, investigations, training and information relating to the causes, control and prevention of water pollution. For this purpose, the act authorizes the Surgeon General to make grants-in-aid to public or private agencies and institutions and to individuals for research or training projects and for demonstrations, and provide for the conduct of research, training, and demonstrations by contract with public or private agencies and institutions and with individuals without regard to sections 3648 and 3709 of the Revised Statutes.

5. Equipment for training in specified scientific fields

S. 4203 (Public Law 1006) introduced by Senator Clinton P. Anderson of New Mexico, was approved on August 6, 1956. It makes a number of amendments to the Atomic Energy Act of 1954 including the following: "The Commission is further authorized to make grants and contributions to the cost of construction and operation of reactors and other facilities and other equipment to colleges, universities, hospitals, and eleemosynary or charitable institutions for the conduct of educational and training activities relating to the fields in subsection a."

The fields listed in "subsection a" are those in which the Atomic Energy Commission is authorized to conduct research and development activities.

6. Extension of veterans' educational benefits

Public Law 7 (H. R. 587) which was introduced by Representative Olin E. Teague of Texas, amended the Veterans' Readjustment Assistance Act of 1952 (Public Law 550, 82d Cong., the Korean GI bill) so that persons who were serving in the Armed Forces on January 31, 1955, may continue to accrue educational benefits under that act until the completion of their military service.

In relation to the question of profesional manpower development, the significance of Public Law 550 as thus amended is illustrated by data published by the Veterans' Administration. As of November 1955, a total of 1,271,000 veterans had entered training under Public Law 550. About half of these, or 643,000, had enrolled for courses in institutions of higher learning. Nearly a third of these college registrants, or 177,000, had enrolled for undergraduate courses not specified. Following is a list of the enrollments in fields which attracted numbers above 20,000.[1]

Business administration	102,000
Engineering	89,000
Education	61,000
Physical and natural sciences	30,000
Medical and related programs	26,000
Law	22,000
Business other than administration	22,000
Social studies	21,000

[1] Veterans' Administration, Department of Veterans Benefits Information Bulletin, June 28, 1956, pp. 5–10. (Numbers taken to nearest thousand.)

All veterans' educational benefits under Public Law 550 as amended will expire not later than January 31, 1965.

7. Expansion of college housing loan program

Two acts of the 84th Congress have indirectly affected the development of professional manpower by liberalizing the college housing loan program.

S. 2126, the "Housing Amendments Act of 1955," introduced by Senator John L. Sparkman, of Alabama, and others, was approved on August 11, 1955 (Public Law 345). One of the effects of this act was to increase the amount of college housing loans that may be outstanding at any time from $300 million to $500 million. The law also liberalized the program by (1) extending the amortization period on loans from 40 to 50 years, (2) specifically including institutions "offering at least a 2-year program acceptable for full credit toward a baccalaureate degree" (i. e., junior colleges), (4) making loans available to housing corporations established by educational institutions, and (5) allowance for loans for "other educational facilities" as well as for housing.

H. R. 11742, introduced by Representative Brent Spence, of Kentucky, was approved August 7, 1956 (Public Law 1020). This "Housing Act of 1956" included provision for an increase of $250 million in the loan fund for college housing—thus raising the fund to $750 million.

From the inception of the college housing loan program in 1950 to July 1, 1956, a total of 320 loans amounting to $241 million were made. Another 205 projects had been committed, with reservations of funds amounting to $175 million, leaving approximately $84 million available for new loans.[2]

8. *Other relevant legislation*

Other laws enacted by the 84th Congress which have some bearing on the development of professional manpower (although the relationship may be relatively slight or indirect) include the following:

(*a*) *Surplus property for educational institutions.*—H. R. 3322 (Public Law 61) introduced by Representative John W. McCormack, of Massachusetts, was approved on June 3, 1955. It amended the Federal Property and Administrative Services Act of 1949 so as to improve the administration of the program for the utilization of surplus property for educational and public health purposes, by including property which has been capitalized in a working-capital fund or other accounting arrangement in several agencies.

Other provisions of the act include a clarification of the authority of the Secretary of Health, Education, and Welfare respecting enforcement of certain conditions imposed on the use of donated property, and respecting cooperative agreements with the State departments of education.

(*b*) *Military training and service.*—H. R. 3005 (Public Law 118) introduced by Representative Carl Vinson, of Georgia, was approved June 30, 1955. It extended from July 1, 1955, to July 1, 1959, the draft provisions of the Universal Military Training and Service Act. It also modified and extended until July 1, 1957, the provisions of the Doctors Draft Act.

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[2] Information obtained from the Housing and Home Finance Agency.

(*c*) *Educational assistance for war orphans.*—H. R. 9842 (Public Law 634) introduced by Representative Olin E. Teague, of Texas, was approved June 29, 1956. It established an educational-assistance program for children of servicemen who died as a result of disability or disease incurred in line of duty during World War I, World War II, or the Korean conflict.

Eligible persons may receive educational assistance for not more than 36 months, generally beginning on the 18th birthday or on the successful completion of secondary schooling, whichever occurs first, and terminating on the 23d birthday.

The educational assistance allowance to an eligible person pursuing institutional courses is $110 a month if courses are full time, $80 a month if three-fourths time, and $50 a month if half time. The allowance is payable directly to the student.

The act also provides for special restorative training to overcome or lessen the effects of a manifest physical or mental disability which would handicap an eligible person in the pursuit of an educational program.

In hearings on this legislation it was brought out that about 156,000 persons are eligible for its benefits. The Veterans' Administration has estimated that the net direct benefit cost over the life of the program will be about $222 million.

(*d*) *Flight instruction during ROTC programs.*—H. R. 5738 (Public Law 879), introduced by Representative Carl T. Durham, of North Carolina, and approved August 1, 1956, authorizes flight instruction to ROTC cadets and extends to them certain benefits given to other members of the Armed Forces.

This act provides for the negotiation of new contracts by the Secretary of the Army, Navy, or Air Force with educational institutions.

(*e*) *Merchant Marine Academy.*—H. R. 6043 (Public Law 415), introduced by Representative Herbert C. Bonner, of North Carolina, was approved February 20, 1956. It directs the Secretary of Commerce to maintain a Merchant Marine Academy at Kings Point, N. Y., for instruction and preparation for service in the merchant marine of persons nominated to the Academy by Senators and Representatives. The number of vacancies allocated to each State shall be proportioned to the representation in Congress from that State.

Cadets appointed to the Merchant Marine Academy may be commissioned as ensigns in the Naval Reserve upon graduation. They shall receive the same pay and allowances as midshipmen at the Naval Academy.

(*f*) *Establishment of a National Library of Medicine.*—S. 3430 (Public Law 941), introduced by Senators Lister Hill, of Alabama, and John F. Kennedy, of Massachusetts, was approved August 3, 1956. It established in the Public Health Service a National Library of Medicine.

The purpose of the Library is—

> to assist the advancement of medical and related services, and to aid the dissemination and exchange of scientific and other information important to the progress of medicine and to the public health. * * *

(*g*) *Facilities for research in health sciences.*—S. 849 (Public Law 835), introduced by Senator Lister Hill, of Alabama, and Styles Bridges, of New Hampshire, was approved on July 30, 1956. It

amended the Public Health Service Act so as to provide for grants-in-aid to non-Federal public and nonprofit institutions for the construction and equipping of facilities for research in the sciences related to health.

The act contains a declaration of policy reading in part as follows:

> The Congress hereby finds and declares that (1) the Nation's economy, welfare, and security are adversely affected by many crippling and killing diseases the prevention and control of which require a substantial increase, in all areas of the Nation, of research activities in the sciences related to health, and (2) funds for the construction of new and improved non-Federal facilities to house such activities are inadequate.

This act may be expected to aid the advanced training of professional personnel in the sciences related to health.

(*h*) *Assistance to federally affected schools.*—H. R. 7245 (Public Law 382) introduced by Representative Roy W. Wier of Minnesota was approved on August 12, 1955. It contained the program (established under Public Law 874, 81st Cong.) of financial assistance to local educational agencies from 1956 to 1957. It provided for transfer to local educational agencies of temporary school facilities made available under Public Law 815, 81st Congress, and effected changes in other provisions of that act.

H. R. 11695 (Public Law 949) introduced by Representative Carl D. Perkins, was approved on August 3, 1956. It extends until June 30, 1958, the programs of financial assistance in the construction and operation of schools in areas affected by Federal activities under the provisions of Public Laws 815 and 874, 81st Congress, and makes a number of amendments to this legislation.

(*i*) *Development of rural library services.*—H. R. 2840 (Public Law 597) introduced by Representative Edith Green of Oregon, was approved on June 19, 1956. It provides Federal aid to the States for the further development of public library services in rural areas. For this purpose it authorizes an appropriation of $7,500,000 annually for 5 years.

(*j*) *Relationship of these laws to manpower development.*—It has been pointed out that the relationship of some of these last-mentioned laws to the problem of professional manpower development may be indirect or slight in comparison with some of the laws reviewed earlier in this report. However, the important long-range effects upon professional manpower development which are attributable to these Federal programs in the field of education should not be overlooked. The potential effects seem too apparent to require detailed discussion here.

9. Appropriations, fiscal 1957

Fiscal 1957 appropriations directly or indirectly related to or potentially affecting the development of scientific, engineering, and professional manpower include the following:

(*a*) For salaries and expenses of the *Office of Education*, Department of Health, Education, and Welfare, the Congress appropriated $5,270,000. This is an increase of $2,030,000 over the appropriation for fiscal 1956. President Eisenhower had requested an appropriation of $6,250,000.

The 1957 appropriation includes $501,250 for increase in educational services and $315,845 for increase in research and statistical services.

(*b*) The fiscal 1957 appropriation for the "further endowment" of the *land-grant colleges and universities* is $2,501,500—the same as requested in the President's budget for fiscal 1957. The permanent appropriation of $2,550,000 for these institutions brings the total to $5,051,000 for fiscal 1957.

(*c*) The appropriation for *agricultural experiment stations* amounts to $29,503,708, the amount of the budget request.

(*d*) The appropriation for *Agricultural Extension Service* (payments to States) is $49,865,000. The budget request was for $50,115,000.

(*e*) For *vocational education below college grade* (George-Barden funds) the Congress appropriated $31,442,000. The budget request was for $28,500,000 or $2,942,000 less than the appropriation, which includes funds for the newly authorized grants to States for training in practical nursing (Public Law 911, 84th Cong.).

There was no appropriation for the vocational fishery education program under Public Law 1027, passed near the close of the second session of the 84th Congress.

(*f*) The appropriation for the work of the President's *Committee on Education Beyond the High School* for fiscal 1957 is $150,000. The Congress adjourned before appropriating funds to encourage and assist the establishment of the State committees, as authorized by Public Law 813 approved July 26, 1956. (President Eisenhower had requested $300,000 for the expenses of the Committee and $800,000 for the grants to the States.)

(*g*) For traineeships for advanced *training of physicians, nurses, and other public health personnel*, under title I of Public Law 911, 84th Congress, the appropriation to the Public Health Services for fiscal 1957 is $1,040,000. For advanced training for professional nurses under title II of that act the appropriation to the Public Health Service is $2,050,000. For the training of *practical nurses* under title III of that act the appropriation Department of Health, Education, and Welfare is $2 million.

(*h*) The appropriations for *aid to schools in federally affected areas* during fiscal 1957 are as follows: For construction $108,500,000, the same as the budget request; for maintenance and operation $113,050,000—$34,050,000 more than the budget request.

(*i*) For *library service grants* the 84th Congress appropriated $2,050,000. A supplemental estimate of the Department of Health, Education, and Welfare was for $7,500,000—the amount authorized by Public Law 597, approved June 19, 1956. The House and Senate conferees on the appropriation indicated that in their judgment the $2,050,000 would be sufficient to initiate the program, allowing each State to receive its basic $40,000 allotment.

(*j*) The appropriation for *international educational exchange programs* of the Department of State is $20 million—the same as the budget request. Some of the international educational exchange programs are administered by delegation and transfer of funds to the Office of Education, Department of Health, Education, and Welfare.

(*k*) The fiscal 1957 appropriation to *Howard University* in Washington, D. C., is $3,300,000—an increase of $209,600 over the appropriation for fiscal 1956.

(*l*) Of major importance to the development of scientific manpower is the appropriation to the *National Science Foundation* of $40

million for fiscal 1957. This represents an increase of $24 million over the appropriation for fiscal 1956.

Not less than $9,500,000 of the appropriation to the National Science Foundation is available for tuition, grants, and allowances in connection with a new program of supplementary training for high school science and mathematics teachers.

(*m*) The appropriation for *Veterans' Education, Training, and Vocational Rehabilitation* during fiscal 1957 is $733,510,000.[3]

(*n*) *Other Federal funds affecting manpower development.*—While noteworthy for the purpose of this report, these appropriations do not account for all Federal funds available for programs and activities affecting the immediate or long-range development of professional manpower in the United States. Outstanding exceptions are certain programs of the Departments of the Army, Navy, and Air Force. Segregation of all Federal funds available wholly or in part for purposes relating to the development of professional personnel in the fiscal year 1957 would be expensive in terms of man-hour expenditure.

Extensive data on Federal Funds for Education, 1954–55 and 1955–56 are contained in a bulletin bearing that title published late in 1956 by the Office of Education, Department of Health, Education, and Welfare (160 pp.).

C. BILLS INTRODUCED BUT NOT ENACTED

During both sessions of the 84th Congress a number of its Members introduced bills which, if reintroduced in the 85th Congress and enacted, would directly or indirectly affect the development of scientific, engineering and/or other professional manpower. This report points out, in layman's language, some of the characteristics of a representative number of these widely varying proposals, and occasionally draws comparisons among them.

Generally a bill was here chosen as representative on the basis of its being the first one of its type which was introduced in the 84th Congress. In many instances bills identical with or very similar to ones here identified were introduced by other Members. The present purpose is to acquaint the reader with the principal features of the various proposals introduced—thus providing an aid to the preparation or consideration of such bills which might be introduced in the 85th Congress.

Many of the 1955 and 1956 proposals have been reintroduced in 1957, in substance if not verbatim. However, the enactment of certain laws by the 84th Congress will, of course, reduce the likelihood of the reintroduction into the new Congress of similar or closely related proposals which were not enacted. Such proposals are therefore generally disregarded in this report.

Many of the bills included herein do not specifically mention the training of scientists, engineers, and/or other professional manpower. These bills would, however, generally promote (and frequently would in effect emphasize) such training along with education in other fields.

Some of the bills represent a direct and others an indirect or incidental approach to the problem of reducing the shortage of scientific,

[3] Public Law 623, 84th Cong., and Budget of the United States for the fiscal year 1957.

engineering, and other professional personnel. Both types of approach have prominent proponents.

For the purpose of this discussion the bills have been grouped in several categories indicative of their basic differences with respect to purpose, philosophy, approach to the problem or other considerations. The groupings are not mutually exclusive.

1. *Grants for needy students of ability*[4] (allowing choice of institution and course of study)

(*a*) The *Student Aid Act of 1955* was introduced as H. R. 2211 by Representative Frank Thompson, Jr., of New Jersey and as H. R. 5422 by Representative Carl Elliott of Alabama. This bill proposed to authorize the appropriation of Federal funds for the purpose of providing scholarship stipends for young persons of demonstrated ability and need, to assist them to attend institutions of higher education.

The scholarships would be worth up to $800 a year each. They would be distributed on the basis of State quotas. Half of the total number of scholarships would be allotted according to each State's share of the Nation's population graduating from high school. The other half of the scholarships would be allotted according to each State's share of the Nation's population between the ages 19 to 21.

The appropriations would begin with $32 million a year and increase by $32 million a year until the authorization would be $128 million.

In each State a scholarship recipient would be required to (1) have a certificate of graduation from a high school of that State, or if graduated from an out-of-State high school, have the course of studies recognized as adequate by his own State, (2) not be eligible for veterans' educational benefits, (3) apply in accordance with State rules, and (4) not have had any Federal scholarship under this or any other act vacated except for good cause.

The United States Commissioner of Education would prescribe objective tests and other measures of the ability of candidates for scholarships. From among those who would qualify under these tests, in each State a commission would select the winners.

The State commission would adjust the stipend to the student's financial need. If continuing in good standing at the institution attended the student would receive the stipend for the duration of his full-time pursuit of a course of study, but not in excess of 4 academic years.

A scholarship winner would be permitted to attend any recognized college or university of his choice. He could choose his field of study from among those approved by the State commission. In time of national emergency, however, not less than 60 percent of the scholarships would be awarded for study in fields determined, in a manner prescribed by the President, to be related to national defense. (Presumably these fields of emphasis would include engineering and other branches of science.) This percentage would be uniformly distributed among the States. In such times the State commission would designate the fields of study for which scholarships charged against the State percentage would be granted. The remaining percentage of scholarship recipients would be free to choose their fields of study.

[4] Primarily scholarship bills; several with loan provisions also.

The payment of the scholarship stipend under the act would be by check payable to the individual recipient. The check would be transmitted to him through the institution attended.

In administering the act at the Federal level, the United States Commissioner of Education would be assisted by a National Council on Student Aid representing individual, organizational, and professional interests.

The act would require the Secretary of Health, Education, and Welfare to consult with all agencies of the Federal Government with a view to coordinate all Federal scholarship, fellowship, and student-loan programs.

The bill would also authorize $10 million for insurance of loans to help students pay their expenses in institutions of higher education. The loan to an individual student could not exceed $600 a year. Repayment by the student of principal, interest, and insurance premium would be required between the fourth and sixth year after his graduation.

The bill proposed for these loans an initial revolving fund of $500,000, with a limitation of $10 million on the principal amount of new loans insured in any year.

(*b*) *The Educational Scholarship Act of 1955* was introduced as H. R. 7839 by Representative Irwin D. Davidson of New York. In some respects this proposal is similar to the bill already described.

The Davidson bill proposed establishment of a program of scholarships for students in higher education to be administered by the United States Commissioner of Education under the supervision of the Secretary of Health, Education, and Welfare. Scholarships would be distributed to selected students each year as follows: 10 to each State; 5 each to Alaska, Hawaii, and Puerto Rico; and 2 each to the Canal Zone and the Virgin Islands.

Grantees would be chosen partly on the basis of their scores on an annual competitive examination to be given by the Educational Testing Service of Princeton, N. J., and partly on the basis of their financial need. The stipend would be $100 a month for an individual without dependents, and more for an individual with dependents.

A scholarship would be usable at a land-grant college or any other accredited institution designated by the Commissioner of Education. The awards would be made without regard to the fields in which the candidates should desire to pursue their education. The stipend could be continued for the duration of satisfactory progress by the student in either undergraduate or graduate courses.

The bill would prohibit any Federal control over the curriculum or program of instruction of any educational institution or over its administration or personnel. It would provide that scholarships be awarded without regard to sex, creed, race, color, or national origin of applicants. It would defer scholarship holders from military duty under the Draft Act, but would require male students to serve in a ROTC unit.

(*c*) The *Student Assistance Act of 1956* introduced as H. R. 8779 by Representative Peter Frelinghuysen, Jr., of New Jersey, is also similar to the earlier proposal by Representatives Thompson and Elliott. However, the Frelinghuysen bill did not specify the size of the Federal appropriation. It would authorize the necessary appro-

priations annually to carry out the purposes of the legislation, taking into account the relative ability of State and other non-Federal sources to meet the need for such assistance. It would leave to the Commissioner of Education the responsibility for determining the number and size of scholarship stipends and loans to students. However, scholarship funds would be apportioned among the States on the basis of the number of high-school graduates (50 percent) and of individuals aged 18 to 21 years (50 percent).

The bill declares the policy of the Congress and the purpose of this act to be—

> (1) to assist in the identification of talented individuals in secondary schools; (2) to stimulate college attendance on the part of talented individuals who would not otherwise be able to attend college; and (3) to identify individuals whose special talents lie in fields where additional trained individuals are needed in order to strengthen the national defense and welfare, and to stimulate those individuals to secure professional and specialized education in those fields.

The bill designates the recipients of the scholarships as national scholars, and would grant to each of these a scholarship and a stipend, or a scholarship only at the option of the awardee. The amount of the scholarship stipend would be based upon financial need and would be limited to a 4-year duration, or to completion of a first postsecondary degree course.

The bill would permit scholarship awardees to select any program of study in any institution of higher education in the United States, or, with the approval of the Commissioner, in any comparable educational institution outside the United States. However, in time of national emergency the President could require that some or all of the new scholarship stipends for any fiscal year be paid to students engaged in fields of study related to the national defense. (These fields presumably would include engineering and other branches of science.)

The proposal would also authorize a program of insured loans, in amounts prescribed by the Commissioner. Repayment would be required between the 4th and 10th year after graduation, at 2½ percent interest plus a maximum of one-half of 1 percent premium.

A 12-member representative National Council on Student Assistance, appointed and chaired by the Commissioner, would advise him on all policy matters pertaining to the administration of the program.

2. Loans to students for higher education (without specification as to fields of study)

A number of bills introduced in the 84th Congress proposed loans to students, without stipulation as to the fields of study for which the loans could be made. The following bills are generally representative of this group:

(*a*) A bill (H. R. 33) introduced by Representative Edward P. Boland, of Massachusetts, proposed loans "*to enable needy and scholastically qualified students to continue post-high school education.*" The bill would authorize $10 million for the first year and such sums as would be needed for succeeding years to support the loans. Recipients would be selected by State agencies in proportion to the number of Members of the House of Representatives from States accepting provisions of the act. Any one of the chosen high-school graduates could borrow, without interest, $1,000 a year for under-

graduate study and $1,500 a year for graduate study. He would be allowed 10 years for repayment of the loan.

The United States Commissioner of Education would administer the program at the Federal level, and legislatively designated State agencies would administer it at the State level.

Each year a State would be required to contribute up to 10 percent of the previous year's advances to sustain the revolving fund.

The bill would assure to all educational institutions attended by benefiting students freedom from interference from Federal or State Governments.

(*b*) A proposal (H. R. 7846) advanced by Representative Abraham J. Multer, of New York, is *similar to the Boland bill.* However, the Multer bill would authorize an initial appropriation of $5 million instead of $10 million and would require an interest payment of 1 percent.

(*c*) The *College Students Loan Act* (H. R. 6304) was introduced by Representative W. R. Poage, of Texas. It would authorize the Secretary of Health, Education, and Welfare to make loans up to $1,500 a year to assist students in pursuing courses at colleges and universities in the United States.

The loan would be repayable in five annual installments, beginning on its fifth anniversary. The loan would bear interest from the date of the borrower's leaving school, at the rate of 3 percent per year on the outstanding balance. On the overdue and unextended balance the interest rate would be 8 percent per year.

(*d*) The *National Student Loan Act* (H. R. 11414) was introduced by Representative Coya Knutson, of Minnesota. It proposed to create a revolving fund to be known as the national student loan fund to support loans to students. It would authorize an appropriation of $10 billion for the fund.

The bill would establish a National Student Loan Board to be composed of three members appointed by the President by and with the advice and consent of the Senate. The duty of the Board would be to make loans to applicant students unable to obtain sufficient funds from other sources. The amounts of the loans would be determined by the Board.

Additional loans could be obtained by a satisfactorily progressing student in the course of his pursuit of an education. Interest at 3 percent would begin 1 year after the student's leaving school. The Board would prescribe the terms and conditions governing the repayment of the loan.

(*e*) S. 3931, proposing to provide for *loans to students* was introduced by Senator William Langer, of North Dakota. The bill proposed a revolving fund authorization of $250 million to support the loans.

From this fund the Commissioner of Education could lend up to $1,000 for any high-school graduate qualifying and needing financial assistance for the pursuit of vocational, technical, academic, or professional education beyond the high-school level. The loans would require promissory notes bearing interest at the rate of 1 percent and maturing in 15 years.

3. Scholarships for science students (including students of engineering)

(*a*) The *Defense Scholarship Act of 1955* was introduced as H. R. 286 by Representative Frank C. Osmers, Jr., of New Jersey, and as

S. 980 by Senator Norris Cotton, of New Hampshire. It proposed to establish a system of scholarships for persons of unusual ability in engineering, physics, chemistry, and related sciences. The Commissioner of Education would be required to conduct, at least annually, a competitive examination to determine eligible candidates for scholarships in these fields.

A scholarship would pay the recipient's educational expenses up to $1,000 a year. The Commissioner of Education would be required to prepare and publish from time to time a list of institutions approved for attendance by individuals holding scholarships.

The bill set forth a system for determining the number of scholarship awards, based primarily upon the scores on the competitive examination.

(*b*) The *National Defense Scientific Education Act* was introduced as H. R. 2179 and H. R. 6176 by Representative Adam C. Powell, Jr., of New York. It would provide scholarships for college or graduate study in engineering, physics, chemistry, or similar scientific fields at institutions approved by the Commissioner of Education. A scholarship would be limited to a value of $2,000 a year, the amount of payment depending upon the financial need of the student.

The award would be made annually but would be renewable for a student making satisfactory progress.

Eligibility of candidates would be determined through competitive examinations under standards established by the Commissioner. From the list of eligibles in a State, each Member of Congress representing that State would be authorized to appoint 50 persons a year to receive scholarships.

The Commissioner would make the scholarship payments directly to the educational institution chosen by the beneficiary.

In administering the program the Commissioner would be advised by a 12-member Commission on National Defense Scientific Scholarships.

(*c*) Representative James T. Patterson, Jr., of Connecticut introduced H. R. 3695 proposing to amend the Atomic Energy Act of 1954 to establish *congressional research scholarships* for undergraduate or graduate study in certain basic sciences specified in that act. The scholarships would be allocated as follows: one to each Senator, Representative and Territorial Delegate in the Congress, for grant to a constituent, 1 to the Resident Commissioner of Puerto Rico, 1 to the Governor of the Panama Canal Zone, and 2 to the Commissioners of the District of Columbia, for grant to residents of the Canal Zone and of the District respectively.

Payments would include a set sum for tuition and living expenses of the recipient and a sum for the college for the expenses of administering the scholarship.

(*d*) A bill, S. 3933, introduced by Senator Warren G. Magnuson proposed to give the *National Science Foundation authority to award scholarships* specifically at the undergraduate as well as at the graduate level. It also proposed to increase the limitation on appropriations for such scholarships from $15 million to $25 million.

(*e*) The *Federal Engineering and Science Scholarship Act* was introduced as S. 3748 by Senator Earle C. Clements of Kentucky. It

would provide 5,000 Federal scholarships for high school graduates to pursue college courses in science and engineering. The scholarships would be awarded on a competitive basis. Each would pay $100 a month to the recipient student during his pursuit of engineering and scientific studies.

Students accepting such scholarships would have to agree to render 4 years' service to the Federal Government after graduation.

4. Aid to teachers and students of engineering

H. R. 11200 introduced by Representative Elmer Holland of Pennsylvania, proposed to amend the National Science Foundation Act of 1950 to *encourage the training of additional engineers and the expansion of facilities for engineering education* by providing supplementary salary grants for engineering teachers, and scholarships and fellowships for engineering students.

The bill would provide supplementary salary payments to bring the total income of engineering teachers up to the level of income generally received by engineers of comparable qualifications in private industry. Payments to approved schools of engineering would be made at such time and in such manner as the Foundation would determine to be appropriate. Recipient schools would be required to agree not to reduce the regular salary of the teacher, and to give the Foundation certain other assurances.

The Foundation would award college scholarships to exceptionally qualified high school graduates with special interest and ability in the field of engineering. The scholarships would be awarded, in order of merit, solely on the basis of competitive examinations held in each congressional district each year. A maximum of 30 scholarships would be awarded in each district.

A scholarship winner would be entitled to pursue his engineering course at any approved school of engineering in the United States which would agree to admit him and accept the payments made on his behalf in lieu of tuition and other charges.

The Foundation would pay to each approved school of engineering for each of the students holding a scholarship under the act and attending that institution an amount equal to the actual cost to the school for educating the student and providing facilities in connection therewith.

To each student holding a scholarship under the act the Foundation would pay directly an allowance of $100 a month for living expenses while actually attending school.

The Foundation would also provide graduate fellowships for individuals holding baccalaureate degrees from approved schools of engineering and willing to agree to devote a period of time to the teaching of engineering in secondary schools. Individuals performing such teaching obligations would receive supplementary salary grants.

On behalf of an individual holding a fellowship under the act the Foundation would pay directly to any approved school of engineering an amount equal to the actual cost to the school of educating such individual and providing facilities in connection therewith. To the fellowship holder the Foundation would pay directly each month an amount equal to the total he was receiving for service in a secondary school under agreement described in the act.

The bill would authorize appropriations necessary to carry out its purposes.

5. Scholarships for students of science and education

The *National Scholarship Act of 1956* was introduced as H. R. 11357 by Representative Thomas L. Ashley of Ohio. The bill proposed to establish a program of scholarships for students in science and education at institutions of higher education. It declared that—

> The Congress hereby finds that there is a serious shortage of teachers and scientists in the United States at the present time, and that such shortage represents an increasing threat to the general welfare and the national defense and security of the United States.

The proposed scholarships would pay the expenses incident to the attainment of baccalaureate and graduate degrees in the specified fields.

The bill would establish within the Department of Health, Education and Welfare a Director of Scholarships who, with the advice and assistance of a National Board on Scholarships created by the act, would administer its provisions.

The Director would hold annual competitive examinations in the fields of science and education for secondary-school graduates. On the basis of scores on this examination and other factors the Director would annually award 50,000 scholarships in education and 20,000 in science.

The number of undergradute scholarships awarded residents of any State would bear the same ratio to the total number of scholarships available in that field for that year as the number of high school graduates in that State for the preceding calendar year would bear to the total number of high school graduates in all the States for such preceding calendar year.

Except in certain unusual instances a scholarship winner could pursue his course of study under the scholarship at any institution of higher education in the United States which would accept him as a candidate for the degree sought.

On behalf of the holder of an undergraduate scholarship the Director would pay directly to the institution the regular charge for the course of study pursued. To the holder of a postgraduate scholarship the Director would pay directly an amount equal to the regular tuition and related charges. In addition, the Director would pay to the holder of either an undergraduate or a postgraduate scholarship the sum of $90 a month for living expenses.

The National Board of Scholarships created by the act would consist of the Director as chairman and 16 members appointed by the Director with the approval of the Secretary of Health, Education and Welfare.

6. Scholarships for medical and dental students

Representative Charles E. Bennett of Florida and Senator Richard B. Russell of Georgia (for himself and Senator Leverett Saltonstall of Massachusetts) introduced the *Armed Forces Medical Scholarship Act* (H. R. 4645, and S. 1444) proposing the procurement of doctors of medicine and doctors of dentistry for the Armed Forces by providing grants and scholarships for education in the medical and dental professions. The scholarships would cover all educational expenses plus $133 per month for selected students in approved medical and dental schools. Scholarship recipients would be required to agree in writing under oath to complete the requirements for gradu-

ation and to serve in the Armed Forces for as many years as they received aid under the program.

The scholarships authorized by the act would be provided for by contracts with educational institutions, approved by the Secretary of Defense, offering degrees in medicine and dentistry. Such scholarships would be established, awarded, continued, or discontinued and the purposes of the act effectuated pursuant to such regulations as the Secretary of Defense would prescribe.

7. Construction of medical and dental school facilities

(*a*) To "relieve the existing and prospective acute shortage of physicians and other health personnel" the *Emergency Health Education Facilities Act of 1955* was introduced as H. R. 3297 by Representative M. G. Burnside of West Virginia. The bill proposed to promote the national defense and security by providing for a temporary emergency program to increase facilities for education in the medical and related professions.

The bill would authorize appropriations totaling $150 million over a 5-year period for grants, up to $15 million each, for construction and equipment of new medical schools. A grant would be contingent upon specified assurances including that of maintenance of the medical school as a public or nonprofit institution for a period of at least 10 years.

The bill would also authorize appropriations totaling $30 million over the same period for grants for improvements of health profession schools. These grants would be made on the basis of need and in the order of estimated importance or value in furthering the purposes of the act. Obtaining a grant would require assurances to the Surgeon General similar to the assurances required for grants for new construction.

To aid the Surgeon General in the administration of the program the bill would establish a National Council of Professional Health Education, consisting of the Surgeon General and the Commissioner of Education (as nonvoting ex officio members) and 11 members appointed by the President.

(*b*) The *Medical and Dental Educational Facilities Construction Act of 1955* was introduced as H. R. 4667 by Representative John E. Fogarty of Rhode Island. It proposed to authorize a 5-year program of grants for construction of medical and dental educational and research facilities, to insure the continued production of an adequate number of properly qualified and trained physicians and dentists, teachers, and research scientists.

The bill would authorize appropriation of $50 million each year for 5 years to be used for construction grants for medical schools and $10 million each year for 5 years for construction grants for dental schools. Except in certain described instances no grant could be in excess of 50 percent of the cost of construction.

Grants to any one school would be limited to $3 million for the total 5-year program, exclusive of $25,000 which could be granted for the preparation of initial plans. Up to 20 percent of a grant for new construction could be allocated to permanent endowment for maintenance.

Regulations with respect to payments to medical and dental schools would be made by the Surgeon General with the aid of advice and

recommendations from the Federal Council on Medical and Dental Facilities created by the act.

(*c*) The *Medical Educational Facilities and Research Act of 1956* was introduced as S. 2925 by Senator Margaret Chase Smith of Maine, for herself and 26 other Senators.

It proposed to create a Federal Council on Medical Educational Facilities to advise the Surgeon General with respect to the administration of a 5-year program for the expansion of medical educational facilities. To support this program the bill would authorize appropriation of $70 million each year for 5 years. From this appropriation the Surgeon General would make grants for the establishment of new public or nonprofit medical schools and for the improvement and expansion of teaching and research facilities in such existing schools.

With certain exceptions grants for construction would be limited to 50 percent of the cost. Total grants to any one medical school would be limited to $3 million.

The Surgeon General would prescribe regulations for and determine the amounts of grants. Up to 20 percent of the grant could be used by the recipient for permanent endowment for the maintenance of the new facility.

To attract young scientists into the field of medical research and for other purposes the bill would authorize appropriation of not to exceed $30 million a year for 5 years for grants-in-aid of medical research facilities. It would create a National Council on Medical Research Facilities to act upon applications for such grants-in-aid and to make recommendations to the Surgeon General in connection therewith.

The bill proposed to divide the United States into four regions and require that the total grants to any region be approximately equal to the total grants to any other region.

(*d*) Representative Peter F. Mack, Jr., introduced a bill, H. R. 9186, in some respects very *similar to S. 2925*, already reviewed. However, the Mack bill proposed to authorize $50 million instead of $70 million a year for the medical educational facilities construction program, and would not provide for the medical research facilities program which would be established by the Senate bill.

(*e*) The *Medical and Dental Research and Teaching Construction Act of 1956* was introduced as H. R. 9013 by Representative J. Percy Priest of Tennessee and as H. R. 9014 by Representative Charles A. Wolverton of New Jersey. It would provide a 5-year program of assistance for construction of medical and dental research and teaching facilities, and would authorize such appropriations as the Congress would determine for this purpose. However, the aggregate appropriations would be limited as follows: for medical research and teaching facilities $210 million, and for dental research and teaching facilities $40 million.

To obtain grants, educational institutions would have to be accredited by bodies approved by the Commissioner of Education, and other institutions must be determined by the Surgeon General to be competent to engage in the type of research for which the facility would be constructed.

The Surgeon General would determine the order in which applications for grants would be approved.

The bill would establish a National Advisory Council on Medical Research and Teaching Facilities consisting of the Surgeon General and the Commissioner of Education, serving ex officio, and 16 members appointed by the Secretary. The Council would advise the Surgeon General with respect to policy matters arising in the administration of the program. The Secretary would be required to make provision for relevant consultation between the Surgeon General and the Commissioner of Education.

8. The "oil-for-education proposal"

What has been widely referred to as the "*oil-for-education proposal*" was expressed in S. 772 introduced by Senator Lister Hill of Alabama for himself and 35 other Senators and H. R. 363 introduced by Representative Carl Elliott of Alabama. Briefly the proposal is that revenue from oil and other natural resources of the federally owned outer Continental Shelf lands of the United States be used for the support of elementary, secondary and higher education.

The bill would create an Advisory Council on Education for National Security, to recommend to the President for submission to Congress a plan for the allocation of the grants-in-aid for education. If enacted, the plan would make available to colleges and universities additional funds, which could be used for scholarships or other forms of aid to students in science, engineering, and other professional fields.

Under the terms of the bill, the Advisory Council on Education for National Security would be composed of 12 persons appointed by the President of the United States with regard to their experience in the relationship of education to national defense and national security. Six of these persons would be from the fields of education and research in the natural and social sciences.

9. Federal aid for school construction (in general)

Nearly 40 bills proposing Federal aid to the States and local communities for school construction were introduced in the 84th Congress. Hearings on S. 4, introduced by Senator Earle C. Clements of Kentucky, and some later bills were held as early as in January 1955. Further Senate hearings were held in February 1955. House hearings on H. R. 14, introduced by Representative Carroll D. Kearns, and some later bills were held in March, April, and May 1955.

H. R. 7535, introduced by Representative Augustine B. Kelley of Pennsylvania, was reported from the Committee on Education and Labor and July 28, 1955. Eleven months later, on June 28, 1956, the House began a 6-hour debate on the bill. On July 5 if failed passage.

Four rollcall votes were taken on the bill, as follows:

(1) An amendment, proposed by Representative Ralph W. Gwinn, of New York, to rebate to each State 1 percent of Federal taxes for school construction was rejected by a vote of 168 to 250.

(2) An amendment, proposed by Representative Adam C. Powell, Jr., of New York, to withhold funds from any State not complying with the Supreme Court decision respecting racial segregation in schools was adopted by a vote of 225 to 192.

(3) A motion by Representative Samuel K. McConnell of Pennsylvania to recommit and report a bill containing an administration formula was rejected by a vote of 262 to 158.

(4) The motion to pass the bill was rejected by a vote of 224 to 194.

The bill would authorize $400 million per annum for 4 years, to be allotted to each State in an amount bearing the same ratio to the total funds so appropriated as the school-age population of the State bears to the total school-age population of all the States. The grants would be conditioned on the approval of State plans by the Commissioner of Education. Standards prerequisite to such approval are set forth in the bill.

For a period of 4 fiscal years the bill would authorize the purchase of obligations of local educational agencies in instances of inability of such agencies to finance school construction on reasonable terms from other sources. It would authorize $300 million as initial capital for the school bond-purchase fund to be used by the Commissioner of Education as a revolving fund for the purchase of obligations of school districts. The aggregate amount of such obligations purchasable would be limited to $750 million. The share for each State would not be permitted to exceed 15 percent of the aggregate principal amount of purchased obligations. Prerequisites to Federal bond purchase are set forth.

It would authorize the Commissioner of Education to enter into agreements on behalf of the United States with State school-financing agencies for making advances to reserve funds established by such agencies to help assure payment of obligations issued by them to finance the construction of school facilities for use and ultimate ownership by local educational agencies.

The bill stipulates conditions to agreements and provides for the establishment of a reserve fund in which Federal and State matching funds would be deposited. It would limit Federal advances to an aggregate $6 billion.

It contains assurances against Federal interference in State school systems.

10. Tax deduction for educational expenditures

(*a*) H. R. 1838 was introduced by Representative Peter W. Rodino, Jr., of New Jersey. It proposed to permit as a *deduction from gross income of all expenses incurred by a taxpayer for the education of a dependent* attending a college or university in excess of the amount allowed normally as the exemption for a dependent.

(*b*) H. R. 4444 was introduced by Representative Donald L. Jackson of California. It proposed to allow a *credit against tax to the extent of 30 percent of the payments by the taxpayer to one or more educational institutions* during the taxable year for the cost of education above the 12th grade of the taxpayer or of any other person or persons.

The credit allowed could not exceed $450 for the education of any one person; however, the total credit allowed might be the sum of the credits on account of the payments made by the taxpayer for the education of other persons. For the purpose of calculating the credit allowed the payments made by the taxpayer for the education of each person would be reduced in the case of a scholarship, fellowship, or training allowance applied to the costs of education of that individual.

(*c*) In the Senate, two comparable bills, S. 3710 and S. 3711, were introduced by the Honorable J. W. Fulbright, of Arkansas. S. 3710 proposed to allow an *additional income-tax exemption* for a taxpayer or a spouse, or a dependent child under 23 years of age who is a full-time student at an educational institution above the secondary level.

S. 3711 proposed to amend the Internal Revenue Code so as to allow a taxpayer to deduct *all expenses incurred at an educational institution* above the secondary level for tuition fees and amounts spent for books and supplies.

11. Further extension of veterans' educational benefits

H. R. 8691 was introduced by Representative Kenneth B. Keating, of New York. It proposed *to extend the educational benefits under the Veterans' Readjustment Assistance Act of 1952 to all veterans* whether or not they served in the armed services during a period of war or of armed hostilities, if such veterans served honorably for a period of 90 days or more, or were discharged by reason of an actual service-incurred disability.

12. Promotion of aviation training

The *Aviation Training Act of 1955* (H. R. 439) was introduced by Representative Carl Hinshaw, of California. It would authorize the Secretary of Commerce to train civilian pilots, technicians, and other persons and to enter into contracts with approved schools to pay for not exceeding 75 percent of such training. After consultation with the Secretaries of Defense and Labor, the National Security Resources Board and the Office of Defense Mobilization, the Secretary of Commerce would determine the numbers and categories of the aviation trainees.

The Secretary would be authorized to contract for the furnishing of aviation training services in accordance with powers invested in him by the Civil Aeronautics Act of 1938, and without public announcement of requests for bids.

The act would require that 5 percent of the trainees be selected from applicants other than high-school and college students. Persons accepted for training would be required to furnish assurance of engaging in or remaining available for aviation employment upon completion of the training. Private and public institutions presenting such training must be certified by appropriate Federal and State authorities as being adequately qualified to do so.

13. Other relevant bills and resolutions

Other representative bills introduced in the 84th Congress which, if reintroduced in the 85th Congress and enacted, might directly or indirectly promote the immediate or long-range development of scientific, engineering, and/or other professional manpower include the following:

(*a*) *Senate bills and joint resolutions.*—S. 4160 was introduced jointly by Senator Lister Hill, of Alabama, and Senator H. Alexander Smith, of New Jersey. It proposed to authorize a new program of assistance to the States and Territories in the *further development of general extension education* emanating from land-grant colleges and State universities.

S. 4179 was introduced by Senator James E. Murray, for himself and Senator Mike Mansfield, both of Montana. It proposed to authorize the Secretary of the Army, the Secretary of the Navy, and the Secretary of the Air Force to make *grants to certain educational institutions for the construction of military and naval science buildings*, and for other purposes.

S. 4293 was introduced by Senator Gordon Allott, of Colorado. It proposed to *promote individual liberty and development through in-*

ternational understanding, by extending the role of American universities and colleges in the field of international education and cultural relations.

S. 4301 was introduced by Senator Lister Hill, of Alabama, for himself and 25 other Senators. It proposed the *extension of vocational education* to persons in areas where programs are not now developed or available and for the development of vocational and technical education (including training made necessary by scientific and technological developments) by encouraging States to establish area vocational schools and programs for the training and retraining of technicians and skilled workers in industry and agriculture and for training in other occupations essential to the Nation's security and economy.

Senate Joint Resolution 159, introduced by Senator Edward J. Thye, of Minnesota, for himself and others, proposed to establish a *Joint Committee on Scientific Research*, to collect and maintain current information on manpower supplies in science and engineering, and to perform other specified duties.

Senate Joint Resolution 174 was introduced by Senator Mike Mansfield, of Montana. It would have made provision for an eight-member commission to study the desirability of establishing a *University of the Americas*, as a center of higher education for the people of all nations of the Western Hemisphere.

(*b*) *House bills and joint resolutions.*—H. R. 2232 was introduced by Representative J. Arthur Younger, of California. It proposed to create a *United States Academy of Foreign Service*, to provide for a trained force for the Foreign Service of the United States, and to provide more adequate and effective orientation and training for technical and other personnel serving with the Foreign Operations Administration.

H. R. 3484, introduced by Representative Katharine St. George, of New York, proposed to provide for programs of *in-service and out-service training for Government civilian employees.*

H. R. 5269, introduced by Representative Carl Vinson, of Georgia, proposed to increase the number of cadets which the President may personally select for *appointment to the United States Military Academy* from 89 to 300, and to apply this amendment to the Air Force Academy.

H. R. 7840 was introduced by Representative Irwin D. Davidson. It proposed to authorize the Commissioner of Education to make grants to finance the preparation, publication, and distribution of *science teaching manuals for use in elementary and secondary schools.*

House Joint Resolution 654 was introduced by Representative Harris B. McDowell, Jr., of Delaware. It proposed the establishment of a joint congressional committee to be known as the *Joint Committee on Expanded College Educational Facilities and Programs* in the United States.

D. PROPOSALS FROM THE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT, JOINT COMMITTEE ON ATOMIC ENERGY

A number of proposals or recommendations for the reduction of our national shortages of skilled manpower are contained in the in-

terim report of the Subcommittee on Research and Development of the Joint Committee on Atomic Energy, dated July 12, 1956. Some of the recommendations would require legislative implementation. Since copies of the brief report are readily available to Members of Congress, the proposals are not repeated here.

CHAPTER XII

NONCONGRESSIONAL PROPOSALS

(Toward the Development of Professional Manpower)

A. INTRODUCTION AND SUMMARY

A study of the literature containing proposals relating to technical and professional manpower development leads to an impression of great diversity among the suggestions.

This chapter reviews and summarizes a number of recent proposals of noncongressional origin which are aimed primarily or secondarily at the development of technical and professional manpower, in general, or in one or more fields. These proposals have appeared in official releases, periodical literature, and other publications. Some of the more specific propositions have constituted the bases for bills introduced in Congress. Altogether, the suggestions include not only action by the Federal Government but also by State and local governments and by business and industry.

In addition to the proposals, in some instances the chapter summarizes related facts and opinions advanced by the proponents.

For the convenience of the reader, the proposals are here presented in two groups: (1) Those emanating from organizations and agencies, and (2) those advanced by prominent individuals.

General and specific measures toward professional manpower development suggested by organizations and agencies (in the form of resolutions and other types of group expression) have included the following:

(1) Allowance of 30 percent of student tuition and fees actually paid by a taxpayer to be applied as a tax credit on the amount of taxes otherwise payable.

(2) Federal aid to colleges and universities for construction and equipment of laboratories and other facilities.

(3) Expansion of the financial-aid-to-education programs of business and industry, foundations, individual benefactors, and the State and Federal Governments.

(4) Provision for every child to develop his abilities to the highest level. (Exact program not specified.)

(5) Establishment of a general Federal scholarship program (similar to that of the GI bill) for prospective teachers.

(6) Federal aid to States for payment of higher salaries to teachers.

(7) Expansion of training of technical assistants to scientists and engineers through 2-year institutions under the supervision of colleges and universities.

(8) Federal promotion of the establishment of area vocational schools.

General and specific proposals and suggestions advanced by prominent individuals have included these:

(1) Establishment of a national policy of Federal aid to education where local and individual resources cannot meet the need.

(2) Development of a Federal program to help able but needy students obtain a college education, and to encourage such students to enter teaching and other lines of work where there are serious personnel shortages. (Exact program not specified.)

(3) Establishment of a Federal Department of Science, and under its administration a Science Corps, as a fourth branch of the Nation's defense forces.

(4) Creation of a United States Science Academy, comparable to the Military, Naval, and Air Force Academies.

(5) Establishment of a national scholarship program for students in higher education.

(6) Federal Government leadership in creating new incentives for teachers, particularly by providing funds for teachers' salaries.

(7) Federal aid to public school construction.

(8) Federal loans to outstanding but needy students to assist them in preparation for teaching.

(9) Amendment of our military service laws on the basis of the principle that every man should serve his country in the capacity in which he can be of greatest value.

(10) Sharing by the Government and by industry of the responsibility for furnishing the additional support needed for basic research.

(11) Federal leadership in meeting educational problems which are national in scope.

(12) More support for education from all levels of Government.

(13) Attack upon our manpower problems on our own terms rather than on the terms of the Soviets.

(14) Undertaking in various ways, as a project of crusade dimensions, elevation of the prestige of the teaching profession so it will offer a rewarding and prestige-gaining career for our abler young men and women.

These briefly stated proposals may be of greater interest when considered in the light of explanations and supporting material brought out later in this chapter.

B. PROPOSALS EMANATING FROM ORGANIZATIONS AND AGENCIES

Following are some of the suggestions for professional manpower development which have emanated from organizations and agencies in the form of official statements, resolutions, or other expressions by their memberships.

1. Tax credit plan to aid students (Proposal by the American Council on Education)

In various actions covering a span of nearly 10 years the American Council on Education has approved the basic principle of Federal aid

to students qualified to pursue higher education. During 1954 and 1955, the Council's committee on relationships of higher education to the Federal Government revived consideration of the matter and concluded that it involves two separable problems: (1) A means of offsetting, for all qualified students if possible, the substantially increased cost of tuition and fees; and (2) a method of selecting and aiding highly qualified students from families not aided, or sufficiently aided, by a general program of the first type.

Early in 1955 committees of the council worked out a tax credit proposal.

At the time of this writing the committee on relationships of higher education to the Federal Government has not completed its formulation of specific recommendations concerning a Federal scholarship program. However, a 6-month study of basic data has been completed as a first step toward revised policy recommendations regarding Federal scholarships.

The proposal to meet the first-named objective is set forth in a detailed statement published by the council in 1955.[1] Approval of this plan was reaffirmed by the council membership at its annual meeting in October 1956. Following are some of the basic facts and ideas contained in the statement from the council.

Serious shortages exist in professions and vocations for which a college education is essential. The supply of college graduates is insufficient in the natural sciences, engineering, home economics, dentistry, medicine, nursing, school teaching, and college teaching, and demands are increasing in the social sciences and humanities. As the population increases, the demand for professional workers increases at a disproportionately higher rate.

With national security resting in the balance the United States is wasting the abilities of many of its most capable youth, of whom a large percentage is financially unable to obtain college education. The financial hurdle for students grows higher each year as institutions are forced to increase tuition and fees to meet rising costs of instruction in the face of decreasing proportionate income from other sources.

Substantial tax relief for student fees paid to tax-exempt public and private educational institutions would yield many (enumerated) benefits.

The plan proposed is that 30 percent of student tuition and fees actually paid by the taxpayer be applied as a tax credit on the amount of income taxes otherwise payable. All taxpayers who pay a given amount of tuition and fees would receive the same tax benefit in dollars, regardless of their income tax bracket.

This plan is supported in principle by the Association of State Universities, the Association of American Colleges, the American Alumni Council, and other educational groups; and it has been specifically endorsed in detail by three committees of the American Council on Education, which represents the entire range of public and private, low-tuition and high-tuition institutions in the United States.

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[1] American Council on Education, A Proposed Tax Credit Plan to Aid Students in Institutions of Higher Learning, 1955.

2. Aid to institutions for construction of facilities, etc. (proposal by the Scientific Manpower Commission)

One of the objectives of the Scientific Manpower Commission as set forth in its program for 1955 and 1956 is—

> to advocate sound policies in education, training, and utilization of scientific personnel, especially if called upon to testify in any legislation that may come before the Congress.

The official views of the Commission bearing on legislation have been expressed mainly in response to questions in congressional hearings, and have dealt with four areas of interest, as follows:

(*a*) *Military service.*—In supporting the special skills provisions of the Reserve Act of 1955 and in testimony on the Hinshaw bill (H. R. 2847, 84th Cong.) the Commission advocated making maximum utilization of highly trained manpower on military technology mandatory rather than merely permissive, when scientists and engineers are fulfilling their military obligation.

(*b*) *Trained teachers.*—In testimony before the Research and Development Subcommittee of the Joint Committee on Atomic Energy a spokesman for the Commission stated that the results in promoting sound agricultural and home economics education under the Smith-Hughes Act has been excellent and recommended that the act be studied to determine whether, by amendment, it may be used to improve and extend the teaching of mathematics and science in our high schools.

(*c*) *Scholarships.*—In several official documents the Commission has registered its opposition to any scholarship legislation that gives preferential treatment to prospective college students in science and engineering, but has expressed favor of subsidizing needy high-school graduates with high ability who might otherwise be deprived of the opportunity to receive college training.

(*d*) *Physical facilities.*—The Commission has, in recent statements and releases, emphasized the urgent need for space and equipment in colleges and laboratories, where physical facilities are already severely taxed by mounting student enrollments. In one official statement, made by the executive director of the Commission, it is suggested that this may be an appropriate field for a program of Federal support.

3. Extension of educational opportunity (proposal by the Association for Higher Education)

The 12th National Conference on Higher Education, on Wednesday, March 6, 1956, unanimously adopted and the executive committee of the Association for Higher Education approved, the following resolution:

Resolution 9—Direct financial assistance to talented youth.—The 12th National Conference on Higher Education calls attention to the continued need for direct financial assistance to able high-school graduates, designed to promote their college attendance. To this end, it urges that all public and private agencies make a greater effort to underwrite scholarship, fellowship, and grants-in-aid programs on a broad and comprehensive basis, that such awards not be limited to students bound for particular fields, and that the stipends be adjusted to economic need. It is further recommended that the Federal Government participate substantially in such a scholarship program.[2]

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[2] Information supplied by the Association for Higher Education.

4. Better utilization of women's services, etc. (proposal by the Educational Policies Commission)

Parts I and II of a study of Manpower and Education by the Educational Policies Commission,[3] published in 1956, deal with America's manpower problem, areas of manpower shortage, underused potentials, and manpower policy and democratic values, with suggested measures for obtaining more trained manpower. A digest of these parts of the report follows:

The harnessing of new sources of power and the development of automation are producing far-reaching changes in industry, agriculture, and commerce. The current industrial and scientific revolutions will produce important changes in social and cultural life with which education must deal.

The country is not faced with a general and long-term shortage of manpower but with acute shortages in a number of areas important to American welfare. The most pressing demands are in the fields of scientific research, engineering and technology, health services, education, managerial activities, and semiprofessional occupations. By reducing the education achievement of youth in schools and colleges, the teacher shortage aggravates the shortages in all other fields.

Military training and research, technical assistance to other countries and other international responsibilities augment the manpower demands in fields of acute shortage.

More manpower can be obtained through measures such as: (1) better utilization of the services of women, minority groups, and older people; (2) further training of the undereducated; (3) vocational rehabilitation of the handicapped; and (4) wide-scale improvements in physical and mental health.

The Nation's manpower policy is a composite of actions and attitudes in governmental, economic, and educational fields. Individual well-being and other democratic values must be emphasized in an acceptable manpower policy.

5. Improving opportunities for the gifted, etc. (proposal by the Educational Policies Commission)

Part III of the study of Manpower and Education by the Educational Policies Commission,[4] published in 1956, discusses education and career, guidance and personnel services, educating the gifted, and obtaining enough qualified teachers, with conclusions and recommendations, a digest of which follows:

The manpower situation has produced an increased demand for education. The growth of the educational task as shown by increased enrollments, seems overwhelming, while shortages in teaching and supervisory personnel are acute problems of schools and colleges.

Under present circumstances the highest possible education of talent is necessary to the national economy. Studies in the humanities and social sciences should receive increased attention in professional and vocational education. There is need for further development of vocational schools, some of them regional.

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[3] Educational Policies Commission. Manpower and Education, Washington, D. C. National Education Association of the United States 1956, pp. 7–63.
[4] Ibid., pp. 64–123.

There should be further experimentation with the articulation and coordination of school and college programs and military training programs. Insofar as the security situation permits, military service should contribute to career training.

Guidance services should be so improved and increased in scope as to involve all who teach and reach all who learn. Counseling should be soundly rooted in understanding of the manpower situation.

In the present manpower situation education of the gifted has a new urgency. Every child should be provided an opportunity to develop his abilities to the highest level. Gifted youth should be identified early and given opportunities which challenge their powers and fully develop their talents.

Inadequate teacher supply is, and perhaps for the coming decade and a half will continue to be, a major obstacle to the production of the trained manpower which is essential for national welfare and security. It is highly important to attract and retain capable teachers in the profession. It is also important that provision be made for increased efficiency in education so as to avoid wastage of teaching talent and improve education itself.

The teacher shortage is a problem for the whole economy, for the security services, and for the full citizenship of the Nation. Only as it is solved will shortages be reduced in other fields for which teaching is prerequisite.

6. A GI bill for teachers, etc. (proposals from State conferences on education, 1955).

Like the White House Conference on Education held late in 1955, the preceding State conferences on education were devoted to discussion, and generally did not lead to adoption of resolutions or issuance of recommendations. However, many suggestions and in some cases formal recommendations emanated from the State conferences. Although the subject of professional manpower development was not on the agenda for the conferences, some of the proposals relate to this question. The following are examples.

The Arizona conference group recommended that—

> Governmental units, citizens, and organizations should provide scholarships to assist interested young people in preparing for the teaching profession.[5]

One suggestion arising from the Oregon discussion was that a well-organized program, "similar to the GI bill" be established to enable qualified young people to become teachers.[6]

A specific suggestion emanating from the Montana conference was that a bill similar to the GI bill be introduced in Congress providing that a student desirous of becoming a teacher would receive a monthly allowance for his teacher training. According to the proposal his debt to the Government would be cancelable by teaching—25 percent the first year and 25 percent for each year thereafter, so that the entire debt would be erased by 4 years of service as a teacher.[7]

A subcommittee of the Illinois Pre-White House Conference on Education, reported the following recommendation:

> Studies of the origin of teachers indicate that middle- and upper-lower class families in the general economic scale supply the majority of candidates for

[5] Report of the Arizona White House Conference on Education, 1955, p. 19.
[6] Report of the Oregon White House Conference on Education, 1955, p. 37.
[7] Report of the Montana White House Conference on Education, 1955, p. 24.

teacher training. Since the shortage of teachers is acknowledged as a national emergency, and since the lack of candidates in training is due largely to lack of funds for college expenses, it is suggested that a national system of scholarships or financial grants be made available, under regulations providing (*a*) successful candidates chosen by examination, (*b*) choice of attending any accredited college for teacher training, (*c*) choice of area for which preparation is made, (*d*) sufficient financial grant to cover annual cost of tuition, fees, books and materials needed, and room and board, (*e*) loan repaid with equal time of service in a public-school system, with privileges of leaves for interim circumstances.[8]

7. General program of Federal scholarships, etc. (proposal by the National Education Association of the United States)

A resolution adopted by the representative assembly of the National Education Association at its 1956 annual convention reads in part as follows:[8a]

Federal grants—The National Education Association reaffirms its belief that the Federal Government has a shared responsibility with States and local communities to assure adequate educational opportunities for all.

(*a*) Scholarships: The association believes that national welfare and the requirements of our democratic society demand the maximum development of the abilities of every individual. Too few of our talented high-school graduates are undertaking post-high-school education at the collegiate level. The lack of financial resources is one of the principal factors in their failure to continue their formal education.

The association, recognizing this, urges the use of Federal funds to establish a general scholarship program for talented youth. This program should be administered by the United States Office of Education working with State departments of education and State and National agencies representative of the general public. Scholarships should be awarded to individuals on the basis of objective criteria of need and ability as determined by the Office of Education and State agencies.

(*b*) Teachers' salaries: The association favors the passage of legislation to provide Federal financial support to the States in financing professional salaries for teachers in public elementary and secondary schools. Funds for this purpose should be apportioned on an objective basis which assures no diminution of State and local effort and should be administered by the United States Office of Education and channeled through the official State education agencies.

(*c*) Vocational education: The association urges the Congress to continue to appropriate funds for vocational education in the full amount authorized by existing legislation and to examine with great care any proposed legislation to modify the present program.

(*d*) Higher education: Increased enrollments in elementary and secondary schools in the present decade are the preludes to vastly increase enrollments of institutions of higher education in the decade to come. College plants must be greatly expanded in order that our colleges and universities may meet the needs of students.

Among the urgent plant needs are student housing and other service facilities. The association urges that as one important means of assistance, the college housing loan program be continued with the interest rate no higher than at present, and that the Federal Government expand the entire program of long-range, low-interest loans.

The association further urges that both the President's National Committee for the Development of Scientists and Engineers and the President's Committee on Education Beyond the High School include in their studies an analysis of what additional Federal funds should be provided to help colleges and universities meet the problem of financing a greatly expanded program of higher education.

8. Recognition of Federal responsibility for certain costs, etc. (proposal by the American Association of Land-Grant Colleges and State Universities)

Following is a digest of suggestions toward relieving the professional manpower shortage contained in 1956 resolutions and policy

[8] Illinois Pre-White House Conference on Education, reports of the subcommittee, p. 47.
[8a] NEA Legislative Commission. NEA Federal Legislative Policy as defined in the platform and 1956 resolution, pp. 6–7.

recommendations of the American Association of Land-Grant Colleges and State Universities.

The association has recommended:[9]

1. Substantial expansion of training of technical assistants to more highly trained scientists and engineers, through 2-year institutions conducted under the supervision of, but geographically separated from, accredited colleges and universities.

2. Increased emphasis on quality and recognition of excellence at all levels, including expansion of summer institute programs to upgrade college and high-school teaching staffs; more advanced fellowship opportunities for young college facuty members; increased recognition of the importance of full-time advanced study in science and engineering, and financial rewards to make it possible; special awards for excellence in teaching and scholarship.

3. More study of reasons for great regional and State differences in production of scientists and engineers, which may be related to the pattern of educational opportunities available rather than other causes.

4. More recognition by the Federal Government of its responsibility for the cost of collegiate programs directly related to Federal programs, such as, specifically: The cost of facilities for ROTC instruction, providing Reserve officers for the Defense Establishment; cost of facilities for training nuclear scientists and engineers; cost of training personnel at the undergraduate level for the vast health research program of the Federal Government.

5. A general program of scholarships and fellowships, not limited to any particular field, designed to get more able needy young people into college; with a maximum limit of $750 on any scholarship.

6. Careful studies at local, State, and Federal levels to determine if and how colleges and universities can provide the necessary facilities to accommodate increased numbers of students, since in many States (particularly in the Northeast) many qualified students are denied admittance to public universities because of lack of facilities.

7. Emphasis on channeling suitable Federal research projects to colleges and universities because of the fact that such research done in colleges and universities helps train research scientists.

8. Endorsement of Federal aid for college and university extension programs which will offer educational opportunities at both professional and technical levels to qualified people in their areas of employment.

9. *Development of area vocational schools* (proposal by the American Vocational Association)

The delegates attending the 50th Annual Vocational Convention, held in St. Louis, Mo., on December 5 and 6, 1956, passed unanimously the following resolution supporting Federal aid to encourage the further development and improvement of area vocational schools and programs in the United States:

Whereas the security and well-being of the United States is dependent in large measure on the efficient productive capacity of our people, and

[9] American Association of Land-Grant Colleges and State Universities. Proceedings of the 70th annual convention, 1956.

Whereas vocational education in its areas of agriculture, business education, distributive education, guidance, home economics, and trade and industrial education plays a major roll in the training of youth and adults in skills, technical and scientific information essential to efficient production and distribution, and

Whereas the high standard of living of the masses in our country is due primarily to the ability of our people to produce efficiently, and

Whereas there is a tremendous demand in all major occupational fields for additional skilled and productive workers, and

Whereas our Nation is engaged in a war of economy with Soviet dominated countries which involves manpower and ability to produce, and

Whereas vocational training needs of this Nation are only about 50 percent adequate, and

Whereas there are few schools, institutions, and programs offering training for technicians, which are so desperately needed in this country: Therefore, be it

Resolved, That we go on record favoring the enactment by National Congress of a measure similar to S. 4301, introduced in the United States Senate during the 84th Congress, authorizing Federal aid to States to encourage and help finance the further development and improvement of area vocational schools and programs of less than college grade: Be it further

Resolved, That we urge the 85th Congress to approve such a measure as soon as possible.

10. Other proposals

The foregoing statements represent suggestions toward the development of professional manpower expressed through formal action by a number of organizations and agencies. However, other organizations and agencies have advanced proposals bearing on this problem.

In April and May 1956, representatives of some organizations and agencies not enumerated above testified in hearings on the shortage of scientific and engineering manpower conducted by the Subcommittee on Research and Development of the Joint Committee on Atomic Energy, 84th Congress. The statements of these persons are not reviewed in this report as they appear in a single printed source available to Members of Congress. The table of contents of the record of the hearings lists organizations and agencies represented therein. It is noteworthy here that some of the persons who testified in the hearings did not, on behalf of the organizations and agencies represented, express positions or recommend policies concerning professional manpower development.

Preliminary conclusions contained in the first interim report to the President from his Committee on Education Beyond the High School and the first interim report on the activities of the National Committee for the Development of Scientists and Engineers are summarized in another chapter of this report.

C. PROPOSALS ADVANCED BY PROMINENT INDIVIDUALS

In the following pages are presented digests of representative manpower-development proposals advanced by individuals who are outstanding in some phase of American life. Comments made by these persons in connection with their suggestions bearing upon professional manpower development are included in the digests.

The selection of proposals for inclusion here has been based upon two considerations: (1) a representation of the ideas of people engaged in a number of occupations; and (2) representation of the variety of proposals which have appeared in recent literature. Suggestions similar to these have been made by other individuals; and proposals different from these have been advanced by still other persons.

Relevant statements and action by President Eisenhower are set forth in the first chapter of this report.

1. Federal aid to able students, etc. (Hon. Adlai Stevenson)

The Program for Education,[10] set forth by the Honorable Adlai Stevenson in 1956, contains the following five proposals, which relate to the problem of professional manpower development:

Proposal No. 1.—The establishment of a national policy of Federal aid to education where local and individual resources cannot meet the need.

Proposal No. 2.—Assumption immediately by the Federal Government of a share in meeting the present urgent financial requirements of our educational system, particularly those for more classrooms and for more qualified teachers.

Proposal No. 3.—A program designed to help insure against able students being denied a chance to have a college education because they can't afford it, and to encourage such students to enter teaching or other lines of work where there are serious personnel shortages.

Proposal No. 4.—Expansion of the exchange programs which in the last 7 years have sent thousands of American students and teachers overseas and have brought foreign scholars to this country.

Proposal No. 5.—Development of new approaches to the challenging opportunities in vocational and adult education.

In connection with these proposals Mr. Stevenson discussed six great problem areas in American education today. The following extracts are from his comments concerning two of these problem areas closely related to the subject to this study.

THE SHORTAGE OF TEACHERS

Today's ominous shortage of qualified teachers had its beginnings in a great national mistake—our failure to give teaching as a profession sufficient reward and honor. Now as the wave of children born during the war begins to grow up, we are paying the price for neglect of our teachers. We do not have enough good teachers—we do not have enough teachers at all. This teachers' shortage may reach proportions of disaster for our culture and our economy.

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Unless we do something to improve the status of our teachers, fewer and fewer of our able and ambitious young people will go into the teaching profession. This can result only in a gradual downward drift of the level of teaching and hence of our whole level of education. It is not just that we need more good teachers—that we need, indeed, the best teachers in the world. Our children deserve nothing less.

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It will not be easy to meet this shortage. It has developed because we have failed to give teaching the dignity and status this vital function deserves. To be blunt about it, we have not paid teachers enough.

We have all heard it said, perhaps said it ourselves, that money isn't everything to a teacher; that teaching is a life of service. But who can doubt that a truly professional standing based on a truly professional salary would make all the difference in the world in attracting fully qualified people into teaching.

"The teachers of this country," said William James, "have its future in their hands." The national neglect of the teaching profession may do incalculable harm to us all.

THE SHORTAGE OF TALENT

We can already see the consequences of our educational shortages. Recent studies by the Commission on Human Resources and Advanced Training have demonstrated that our schools and colleges are not meeting the growing demands of our country for specialists—men and women trained to do the important jobs of our society. Business and government, society as a whole, needs more scientists, engineers, doctors, social scientists, teachnical experts, psychologists; above all, we need more good school and college teachers.

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[10] Stevenson, Adlai. The New America: Adlai Stevenson's Program for Education, 4 pp.

It is too bad that it takes a divided world to bring these shortages home. In the first 5 years after 1950, the number of young people who earned engineering degrees in this country dropped from 52,000 to 23,000, while in the same period in the Soviet Union the number of graduates from technical schools offering courses equivalent to those of our engineering schools grew from 28,000 to 63,000. Russia's gain practically equaled our drop, and Russia is now producing 2 engineers for each 1 we turn out.

I do not suggest that we should set our sights or determine our needs by comparison with the Soviet Union. But Communist power may be explained as much by Communist investments in education as by any other one thing. And I think we might well ask ourselves whether a free people by free decision will also be prepared to make this best of all investments—investments in the education of its youth. The answer must be "Yes."

The shortage of trained technicians is by no means our only, or perhaps even our greatest, want. In a free society, where the will of the citizen is determining, we need, above all, citizens with a good liberal-arts education. We need businessmen and working men and women who know our history and our literature and the values of our civilization; we need specialists and experts, to be sure, but specialists who know far more than their specialties, who are, first of all, educated people. We need poets as well as public rewards—yes; and we need politicians. A group of scientists at the California Institute of Technology recently concluded that the most critical bottleneck to future national growth would be, not natural resources, but "brainpower."

And I want to say that I see these shortages as causes for concern, but surely not for dismay. They reflect the fact that our dynamic society has an insatiable appetite for capable, well-educated people. As we feed that appetite, we move toward the new America.

2. A Federal Department of Science, etc. (Prof. Emile Benoit)

Following is a digest of proposals and related comments by Emile Benoit, former Foreign Service officer, now associate professor of international business at Columbia University, New York City.[11]

Recently, well-informed people in the United States have come to the horrifying realization that we could lose the scientific and technological race with the Soviet Union. We are already losing the race for technical manpower. Russia is already producing almost twice as many engineers as we, and is preparing to produce in the next 5 years nearly 3 times as many as we.

In Russia, a third of all science graduates are assigned to teach science in the secondary schools. In the United States, few will consent to teach science and many who have been teaching it are deserting their classrooms to accept jobs in industry.

In the Soviet Union, education has been made free at all levels. The national government pays students in institutions of higher education generous stipends for living expenses. In the lower schools, mathematics and science are heavily emphasized.

In Russia, material rewards to graduate scientists and engineers are made high enough to provide the strongest incentive to students to complete their education and stay in their chosen profession.

Unless we do something drastic to speed up our technical manpower buildup there is an ominous possibility of Russia's gaining world industrial leadership within two decades. We need to more than double our output of scientists and engineers to keep ahead of the Soviets.

Our experience with the GI bill shows the effectiveness of Government subsidization of higher education. The number of graduates in science rose from 33,000 in 1948 to 61,000 in 1950 (the peak of GI subsidies), then fell to 31,000 as the program subsided in 1955.

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[11] Benoit, Emile. Competitive Coexistence: Can We Win? The Antioch Review, Summer, 1956, pp. 146–160.

Our greatest danger here lies in a mental block against Federal activity in the field of education. All admit that the production of airplanes and the training of those who will operate them is "defense," and a Federal responsibility. However, some regard the training of those who design the planes and discover the principles on which they may be improved as "education," and classify Federal activity in this area as "intervention." This is the nonsense by which we are betrayed. Our survival today is more dependent upon scientists and engineers than anyone else. If their education is not defense; what is?

The following program is proposed:

1. Establishment of a Department of Science with independence and "parity of esteem" equal to that of the Department of the Army, Navy, and Air Force.
2. Creation of a "Science Corps" as a fourth branch of the Nation's defense forces, somewhat comparable to the "Regular" NROTC, but under the Department of Science. Enlistees would pursue subsidized courses in science and engineering at colleges and universities.
3. Establishment by the Science Department of a "Science Academy" comparable to the Military and Naval Academies.
4. Initiation of special programs, such as science summer schools.

3. A national scholarship program, etc. (former Senator William Benton)

Following is a digest of an address by Mr. William Benton, publisher of the Encyclopaedia Britannica, before the 11th Annual National Conference on Higher Education in March 1956.[12]

Education has become a main theater of the cold war. Russia's classrooms, libraries, laboratories, and teaching methods may threaten us more than her hydrogen bombs or guided missiles.

For decades the Soviet Union has had a long-range plan for ideological and economic world conquest—a plan so potent as to make her military and political maneuvering seem diversionary. The heart of this project is training and indoctrination of scores of thousands of professional and technical personnel to help develop the resources of countries outside the Soviet orbit and convert the world to communism.

The U. S. S. R. has already surpassed us both in the number and percentage of students enrolled above the secondary level with 4,300,000 in 1955—70 percent over our 2,700,000.

Communists early gave up butter for guns; but they gave up meat for education.

Dominating Moscow is its university, completed in 1953 at a cost of at least $150 million, more than has been spent for the completed physical plants of all but a few American universities. It symbolizes to Russians what lies ahead in the fulfillment of Soviet ambitions for youth.

The growth of Soviet education is spectacular and its output explosively expanding. In order to compete we must take four actions.

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[12] Benton, William. Soviet Education: Renewed Challenge to the American People. In Current Issues in Higher Education, Association for Higher Education, Washington, D. C., 1956, pp. 29–42.

First, instead of continuing to waste much of our manpower potential we must develop the imagination and courage to embark upon an adequate Federal scholarship program. The Federal Government should initially provide 20,000 scholarships a year and increase the number as fast as the absorptive capacity of the colleges permit to 100,000 scholarships a year. To these should be added 20,000 or more graduate fellowships.

Second, without delay, and on a bold scale, we must develop new incentives for teachers.

We must turn to the Federal Government for leadership in providing several additional billions of dollars annually for salaries, to attract and keep uncommonly promising teachers.

Third, we must face up to the need for Federal legislation to stimulate public-school construction up to a rate of $3,800,000 a year. If the public knew all the facts it would put up the money.

Fourth, we must reexamine our teaching methods and our institutional setup. Let us consider such measures as lengthening the schoolday, compressing the time required for earning a doctorate degree, creation of more and better junior colleges, and establishing United States technical assistance academies—equal in status to the Military, Naval and Air Force Academies—to educate picked young men and women for overseas service under our point 4 program.

4. Federal scholarship loans (Dean Lindley J. Stiles)

Lindley J. Stiles, dean, School of Education, University of Virginia, has proposed alleviation of the teacher shortage by provision of Federal scholarship loans. Following is the substance of his article in the Nation's Schools:[18]

Efforts by citizens, professional groups, and State agencies to recruit teachers have proved inadequate to cope with the growing shortage of competent persons in the teaching profession. There is an increasing need for more teachers to replace dropouts and care for an additional 2 million children annually.

Too few of our able young people care to choose teaching as a career today. A college graduate able to teach mathematics or science generally must make a sacrifice of $2,000 to $3,000 a year to do so.

Teacher's salaries are unattractive to young men whose families are able to pay for their college educations. To fill the demand for teachers it will be necessary to recruit from the ranks of superior high school graduates who lack the financial resources to obtain the necessary preparation.

Like our network of Federal highways, the teacher shortage reaches across State lines, and therefore is a national problem. A Federal teacher scholarship loan program might be patterned after the Virginia system which has enabled between 12,000 and 13,000 young people to prepare for teaching within the past 8 years. The prospective teacher who receives a scholarship loan to attend college is required either (1) to cancel the loan with 1 year of teaching in Virginia for each year of scholarship assistance, or (2) repay the loan plus 3 percent interest. To date in Virginia 96 percent of such scholarship loans have been canceled by teaching.

[18] Stiles, Lindley J. Federal Scholarship Loans. The Nation's Schools, June 1955, p. 51 et seq.

Experience with the veterans' educational grants has proved that the Federal Government can help individuals attain a college education without interfering with the nature or control of either public or private educational programs.

This proposal is for utilization of the instrument and resources of the Federal Government to establish a program of full-cost loans for (1) outstanding but needy high school graduates to prepare for teaching, (2) teacher training for graduates of liberal arts colleges, and (3) graduate fellowships for superior students preparing for college teaching or for educational leadership and specialization.

It is difficult to estimate the damage the teacher shortage is causing to our military preparedness and economy and to our ultimate chance of survival as a free people. Our personnel shortages in other fields are largely due to our inadequate supply of able teachers. The quality of education of the Nation's citizens tomorrow rests squarely upon the competence and adequacy of the teaching force being trained today.

5. Modification of military service laws, etc. (Mr. B. F. Hake)

A lecture on scientific manpower and national safety was given by B. F. Hake, chairman of the committee on national responsibility, of the American Association of Petroleum Geologists, in January 1956. Following is a digest of his proposals and supporting comments.[13a]

The Soviet Union has acquired dominion over 600 million people of other nations, and over vast resources; and she is irrevocably dedicated to domination of the whole world. She had made phenomenal progress in education and rivals the United States in industrial and military might.

Since the United States represents the chief obstacle to unrelenting Soviet ambitions we may expect attack unless we maintain sufficient military potency to discourage it. Maintenance of our national safety will require of us a gigantic effort, especially in scientific research and development, for which a shortage of qualified personnel already imperils the Nation.

It appears that we will need annually a minimum of 50,000 new engineers and scientists, whereas our colleges are graduating only about 30,000 a year. Russia is producing annually 3 times as many physicians as the United States, twice as many engineers, and 60 percent more agricultural specialists.

The drift away from mathematics and physical sciences in our high schools is due largely to the inadequacy of their teaching staffs, which in turn is partly due to the shamefully low salary scales in most of our high schools. While our national annual demand for new high school teachers is about 48,000, only about 28,000 of our college graduates are accepting teaching positions each year.

Recognizing that some educated specialists are more valuable to the Nation in their professional capacities than in the Armed Forces, the Soviet Union gives students in a number of technical schools blanket exemption from military duty, and allows some other students occupational deferments amounting to exemption. In contrast, in the United States young men who are capable of solving scientific prob-

[13a] Hake, B. F. Scientific Manpower and National Safety. Bulletin of the American Association of Petroleum Geologists, July 1956, p. 1473 et seq.

lems vital to the national safety may be required to spend time practicing the manual of arms and serving as kitchen police.

We should alter our laws regulating military service so as to: (1) establish the principle that every man should serve his country in the capacity in which he can be of greatest value; and (2) provide adequate administrative means for the consistent application of that principle.

Additionally, we need to improve our high school systems, provide decent salaries for teachers, increase emphasis on the teaching of science and mathematics, and stimulate student interest in scientific and technological careers.

6. Strengthening education and research (Hon. Alan T. Waterman)

An address by Dr. Alan T. Waterman, Director, the National Science Foundation, was delivered at the 1956 convention of the Air Force Association at New Orleans. The following digest emphasizes the proposals and related data set forth in the address.[14]

Most of the manpower problems that we face today have arisen within the last decade. Today's professional manpower problem has two major aspects: (1) How can we provide our young people opportunity for education up to their highest talents? (2) How can we provide adequate numbers of scientists and engineers in this age of rapid technological progress?

Most nations are aware that the world is experiencing a technological revolution and are making all-out efforts to increase their numbers of scientists and engineers. However, our problems may differ from those of other nations and we should face squarely our own national needs and goals.

Of the Nation's 250,000 scientists, industry has about 60 percent, education about 20 percent, and government about 20 percent. Of our 700,000 engineers, 75 percent are in industry, 2 percent in education and 23 percent in government. Our economic and military strength depend upon meeting the needs of the three consumers of technical skills—industry, education and government. There is a critical shortage in some but not in all fields, and there is a constant demand for highly qualified personnel in all fields of science and engineering.

Industrial demands for more highly trained personnel include those for scientists, engineers, and mathematicians. By drawing mathematics and science teachers from schools, colleges and universities, industry may create greater problems for the future.

Encouragement and support should be provided for basic research across all the fields of science. Government and industry should share the responsbility for furnishing the additional support needed for basic research and for maintenance of a proper balance between basic and applied research.

In order to train enough scientists and engineers we must first strengthen our whole educational system and provide much stronger incentives for good teachers.

Steady and rapid progress has become a normal part of our national life. Skilled manpower to keep up with this kind of progress will be in demand for years to come.

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[14] Waterman, Alan T. The Shortage of Scientists—A Problem and an Opportunity. Air Force magazine, September 1956, p. 59.

7. More support from all levels of government (Hon. Marion B. Folsom)

On October 11, 1956, the Honorable Marion B. Folsom, Secretary of Health, Education, and Welfare, delivered an address at the annual meeting of the American Council on Education. Following is the substance of his proposal for more support for education from Federal, State, and local governments and for other measures affecting the professional manpower problem:[15]

American education is confronted with a three-dimensional problem of *quantity* (tremendous and increasing student enrollments), *quality* (how well knowledge and skills are imparted), and *currency* (teaching the right thing at the right time).

Our progress in education will be stalemated unless the American people accept and act upon the fact that more money for education must be contributed by all levels of government—local, State and Federal. It will be tragic if we permit shortages of trained people to choke our progress and weaken our security.

The national interest calls more clearly than ever before for prompt and sound Federal aid for school construction. The American people must reach a new determination to compensate our teachers more adequately—in salary, in community support and in honor for the trust they bear.

The President's Committee on Education Beyond the High School is giving thought to such fundamental questions as: Who should pay the bill? What responsibility should the Federal Government assume for assuring youth the opportunities needed?

In considering our shortage of scientists and engineers and the rapid advances Soviet Russia is making in technical education we should take into account several facts: First, Russia must make a strenuous effort in science and technology just to catch up with us in these fields. Second, if the Soviets are outproducing us in science and engineering graduates they are doing so only by giving the sciences an overriding priority in education. Third, although we face shortages of trained scientists and engineers we also have shortages in other categories of trained professional personnel. Perhaps most critical of all is the shortage of school and college teachers. In our zeal to provide scientists and engineers we must not overlook the needs in other professions.

Of every 20 children who start life together only 16 enter high school, only 11 graduate from high school, and only 2 graduate from college. There is an appalling waste of the Nation's most valuable resource—the brainpower of its youth. We must provide more money and motivation for our alert young people to continue their education.

Sponsors of a Federal scholarship program contend that only the Federal Government has the taxing power and resources to remove the financial barriers to higher education. Opponents contend that Federal scholarships would tend to discourage private contributions, individual initiative and State efforts to meet the problem.

A blind and unreasoning fear of Federal intervention should not be permitted to stifle Federal leadership or nationwide action to meet problems which are national in scope. The role of the Federal Gov-

[15] Folsom, Marion B. Address before American Council on Education, Chicago, Ill., October 11, 1956. Processed, 14 pp.

ernment is to provide national leadership and assistance in education by methods that encourage State and local effort and responsibility.

8. National solution for a national problem (Gen. Nathan F. Twining)

An address entitled "Behind the Manpower Eight Ball" was delivered by Gen. Nathan F. Twining, Chief of Staff, United States Air Force, at the 10th Annual Convention of the Air Force Association, at New Orleans, in August 1956. Following is a digest of that part of his address suggesting that the solution to the professional manpower problem of the United States must be national in scope and nature:[16]

The problem of meeting our technological needs and broadening our scientific base is a most serious one. We are challenged now as we never have been in the past.

The Soviet leaders are obviously proud of their educational system and their ability to turn out scientists and engineers and they have some good reasons to be proud.

In the Academy of Science of Moscow University alone there are 20,000 Russian students, and this is only one school of a wide system of engineering and science colleges.

Considerable incentive is provided the students. They receive 400 rubles a month, and if their grades are superior they get 600 rubles a month—a fairly good salary by their standards. According to a statement by a graduate of the Zhukovski Air Engineering Academy the work there is comparable to postgraduate courses in American colleges.

Our continued progress depends upon people, trained, experienced, skilled people in science, industry, and the military services. Our manpower problem is a national problem. It must have a national solution.

The security of our Nation in the years ahead depends as much on the wisdom and skill of our engineers, scientists, and technicians as it does on the courage of the fighting men in our Army, Navy, and Air Force.

9. Creation of respect for scholarship, etc. (Maj. Gen. James McCormack, Jr., USAF, retired)

Gen. James McCormack, Jr., assistant to the president of Massachusetts Institute of Technology, delivered an address at the annual convention of the Air Force Association, at New Orleans, in August 1956. In approaching the topic he pointed out that most of the problems in the field of technical education are reflections of the broader problems of education generally in the United States. A digest of his suggestions and related comments follows:[17]

The needs of education are great and urgent. There are continuing needs for classrooms, for equipment, and, most important of all, for teachers.

About 11,000 qualified mathematics and science teachers are needed annually to begin work in our high schools, but only about 8,000 are

[16] Twining, Nathan F. Behind the Manpower Eight Ball. Air Force magazine, September 1956, p. 55.

[17] McCormack, James, Jr. The Needs of Education in the Manpower Shortage. Air Force magazine, September 1956, p. 64+.

appearing. Efforts to correct this situation have had little effect to date.

Only about half of the 70,000 persons teaching science in our secondary schools do so full time. In the Soviet Union a specific number of mathematics and science teachers are trained annually and assigned to teach those subjects at the secondary level.

The Soviets surround the teaching profession with great prestige. We must create such attractions to draw the necessary number of people into this critical profession.

In many high schools within the United States the physical equipment for teaching science is inadequate. Furthermore, the training aids and their concept are extremely rudimentary in comparison with the sophistication in the military services and industries of the country.

Two-thirds of the top 50 percent of the high-school graduates in the United States do not graduate from college. It is vitally important to consider this matter in any efforts to increase the supply of competent scientists and engineers. In this connection it is perhaps even more important to note that one-third of the top 2 percent of our high-school graduates do not obtain college degrees. Thus in these times of critical need for talent about 10,000 persons are lost from the absolute top of our high-school graduating classes.

We should make sure there are no gaps in the financial aid available to these young people. We have, however, a tougher problem of creating in this country an atmosphere where scholarship is genuinely and meaningfully renowned.

One most important aspect of the problem of attracting the necessary number of good teachers at all educational levels is the salary schedule. A profession must offer some of the good things of our material civilization to attract a reasonable proportion of our better qualified youth. This is particularly significant in relation to the fact that a shortage of good teachers has the unique potency of multiplying all other shortages in the development of succeeding generations.

To restore our high school and university teachers to the relative economic positions they occupied 50 years ago would require an average increase of 70 percent in their salaries. One industrialist has said that—

> When a teacher's income gets up to the point where you will seriously suggest to your boy that he give consideration to teaching as a profession, then we may be approaching the right figure.

10. Face problem on our own terms (Dr. Nicholas DeWitt)

Dr. Nicholas DeWitt of Harvard's Russian Research Center spoke at length on the above subject at the annual convention of the Air Force Association, at New Orleans, in August 1956. Following is a digest of his remarks.[18]

In the Soviet Union the maxim that "knowledge is power" has been a guiding motto for the last three decades.

Within the last 25 years the Soviet population has increased from about 160 to about 200 million, or 25 percent. However, during the

[18] DeWitt, Nicholas. The Russian Manpower Situation. Air Force magazine, September 1956, p. 62+.

same period the primary and secondary school enrollment has increased from about 10 to 30 million, or 25 percent. The number of primary and secondary schoolteachers has risen from 250,000 to well over 1,500,000, while the number of science teachers has increased from 40,000 to 350,000. Enrollments in higher education have risen from 180,000 to nearly 1.9 million. These figures clearly suggest that the development of Soviet trained manpower has been at a substantially greater rate than the growth of global population.

The Soviets now have about 550,000 engineers, 300,000 medical doctors, and close to 200,000 agricultural specialists. It appears that the Soviets are graduating specialists at a faster rate than all other countries combined. In scientific and technological fields the Soviet Union has reached a position of close numerical comparability with the United States. It is possible to estimate that within the next 5 years the Soviets will graduate about 120,000 engineers—at about 3 times the rate of the United States.

The Soviets have used the following four methods to develop their professional manpower: (1) With heavy emphasis upon the needs of the National Government, the Soviet Union exercises a strong and persistent policy of promoting all kinds of formal education, especially scientific training; (2) The Government-owned and centrally controlled Soviet educational system weeds out the less competent and maintains established standards of learning; (3) The Soviet educational system is entirely tuition-free and furthermore provides living allowances for successful students with bonuses for outstanding students and monetary incentives for the study of science and engineering; (4) Since the entire educational system is controlled by the National Government it can easily determine the enrollment quotas in all specialized fields.

We and the Soviets operate within vastly different social, political, and economic frameworks. We should face our engineering and scientific manpower problems on our own terms.

11. Creation of teaching incentives (Mr. Charles G. Mortimer)

In a recent address at Stevens Institute of Technology, Hoboken, N. J., Mr. Charles G. Mortimer, president of General Foods Corp., discussed "What Discourages Our Potential Engineers?" [19] Following is the substance of his remarks:

The shortage of engineers presents a grave problem, not only to heavy industry but to the food business. The basic cause is that not enough young people are attracted either to technological careers or to teaching careers in technological subjects.

Misconceptions about the qualifications and contributions of engineers contribute to the problem. The attitude that science and technology are obscure, and hence suspect, helps to account for the woeful fact that only 1 out of every 22 high-school students studies physics. Engineering has been presented in lack-luster terms, and must be restated in lustrous, dynamic terms to win appeal. It has been excluded from the social register of aristocratic arts and should be truly represented as imaginative and creative.

A final point is basic not only to solving our engineering shortage but also to the proper education of all our youngsters. If America

[19] Mortimer, Charles G. What Discourages Our Potential Engineers? Unquote, summer 1956. Pp. 12–14.

is to progress the teaching profession must have popular reinstatement as a rewarding and prestige-gaining career for our abler young men and women.

In permitting the teaching profession to languish without new and revitalizing incentives—both monetary and spiritual—we are borrowing, perhaps disastrously, against the future. Our task of righting this wrong is a project of crusade dimensions.

12. Proposals by other prominent persons

The basis of selection of the foregoing proposals for summary in this report has been set forth earlier in this chapter. In conclusion the writer wishes to emphasize that other prominent individuals have advanced proposals toward the development of professional manpower in the United States. Statements expressed by some of these persons as individuals rather than as chosen representatives of organizations and agencies are included in the record of the hearings on the "Shortage of Scientific and Engineering Manpower" conducted in April and May 1956 by the Subcommittee on Research and Development of the Joint Committee on Atomic Energy, 84th Congress. Since they appear in a single, printed source available to Members of Congress these statements are not reviewed in this report.

Some other suggestions for improving our technical and professional manpower situation appear in chapter VII of this report entitled "Digest of Published Opinions."

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